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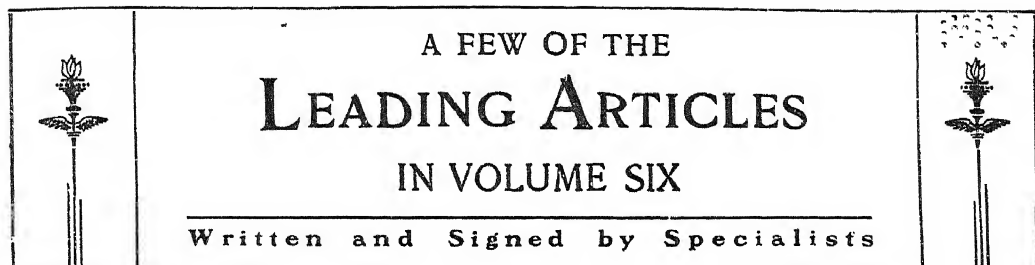
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



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## KEY TO PRONUNCIATION.


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ä	far, father	ñ	Span. <i>ñ</i> , as in <i>cañon</i> (căn'yôn), <i>piñon</i> (pên'yôn)
ā	fate, hate	ng	minglc, singing
a or ă	at, fat	nk	bank, ink
ā	air, care	ō	no, open
ā	ado, sofa	o or ǒ	not, on
â	all, fall	ô	corn, nor
ch	choose, church	ó	atom, symbol
ē	eel, we	o	book, look
e or ě	bed, end	oi	oil, soil; also Ger. <i>eu</i> , as in <i>bcutel</i>
é	her, over: also Fr. <i>e</i> , as in <i>de</i> ; <i>eu</i> , as in <i>neuf</i> ; and <i>oeu</i> , as in <i>boeuf</i> , <i>coeur</i> ; Ger. <i>ö</i> (or <i>oe</i> ), as in <i>ökonomie</i> .	ö or oo	fool, rule
ę	befall, elope	ou or ow	allow, bowsprit
ē	agent, trident	s	satisfy, sauce
ff	off, trough	sh	show, sure
g	gas, get	th	thick, thin
gw	anguish, guava	th	father, thither
h	hat, hot	ū	mute, use
h or H	Ger. <i>ch</i> , as in <i>nicht</i> , <i>wacht</i>	u or ŭ	but, us
hw	what	ù	pull, put
ī	file, ice	ü	between u and e, as in Fr. <i>sur</i> , Ger. <i>Müller</i>
i or ĭ	him, it	v	of, very
î	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din	y	(consonantal) yes, young
j	gem, genius	z	pleasant, rose
kw	quaint, quite	zh	azure, pleasure
ñ	Fr. nasal <i>m</i> or <i>n</i> , as in <i>embonpoint</i> , <i>Jean</i> , <i>temps</i>	' (prime), " (secondary)	accents, to indicate syllabic stress

# THE ENCYCLOPEDIA AMERICANA

**D** the fourth letter of the English alphabet and the third consonant, is a sonant dental corresponding to the mute dental T. It holds the same place in the alphabets of the Phœnician, Syrian, Chaldee, Hebrew, Samaritan, Greek, and Latin, and in those of all the modern European languages, except the Russian and the two or three others which retain the Cyrillic alphabet; in these the symbol of delta is the fifth letter. The most ancient forms of the symbol D in the languages of Phœnicia, Palestine, etc., are angular with the vertex pointing to the left, for example, , , and the most ancient Greek form was the same angular figure reversed,  (changed afterward to ). In some ancient Greek inscriptions in Hellas itself and in the Greek colonies the angular form of the primitive delta () is rounded to the form D, and this form was adopted by the Latins, who got it from the Greeks settled in the southern extremity of the Italian peninsula. The sound of D is produced by pressing the end of the tongue against the upper gums and then forcing the vocalized breath into the mouth. The point of contact of the tip of the tongue with the gums in articulating the sound of D in English pronunciation is a little higher above the insertion of the teeth than when the D of those speaking other languages is sounded, and the same is to be said of the production of the sound of T: the d of continental Europeans is nearer to dh than to the sound of d in English speech. Hence the English sound is alveolar rather than dental. The letter D in very many English words represents an element in the speech of our early language ancestors which became for the Greeks theta (*θ, th*), for the Latins *f*, for the Germans *t*, for example, Eng. *deer*, Gr. *θηρ*, Lat. *fera*, Ger. *tier*. More curious is the change of the Greek name *Odysseus* to the form *Ulysses* in Latin, and within the Latin language itself the change of *olor* to *odor*, and from *dacrima* to *lacrima*. In many words in English *d* is intercalated or appended for phonetic reasons, for example, Old English *thonor* becomes *thunder*, Old English *soun* becomes

*sound*, Norman English *jaunisse* becomes *jaundice*; on the other hand the *d* is dropped out of some words, for example, Old English *woodbind* becomes *woodbine*; *godsib*, *gossip*; *godspel*, *gospel*.

D is the Latin numerical symbol for five hundred. The ancient Romans represented a thousand by the symbol CIO, and they took one half of that symbol to express half a thousand, five hundred (IO, which came to be written D). The symbol D with a horizontal stroke over it () stood for five thousand. In Roman personal names D stood for the prænomen Decimus; thus D. Junius Brutus.

As an initial it is used:

1. In chronology, (1) For *Domini*, genit. sing. of Latin. *Dominus*=Lord, as A. D.=*Anno Domini*=in the year of our Lord. (2) For died.

2. In music, as an abbreviation for *Discantus*, *Dessus*, *Destra*, etc.

3. In university degrees, etc., for Doctor, as M.D.=Doctor of Medicine; D.C.L.=Doctor of Civil Law; D.D.=Doctor of Divinity; D.Sc.=Doctor of Science, etc.

4. In English titles, for duke.

D as a symbol is used:

1. In chemistry, didymium.

2. In music.

(1) For the first note of the Phrygian, afterward called the Dorian, mode.

(2) For the second note of the normal scale of C corresponding to the Italian *re*.

(3) For the major scale having two sharps and for the minor scale having one flat in its signature.

(4) For a string tuned to D, for example, the third string of the violin, the second of the viola and violoncello.

(5) For a clef in old mensurable music, *D excellens*.

(6) For *do* in the tonic sol-fa system.

3. In biblical criticism, for the Beza manuscript of the Greek New Testament.

4. In commerce, for English penny or pence, as £ s. d.=pounds, shillings, and pence, being the initial of Latin *denarius*.

**Daae**, dǎ'é, Ludvig, Norwegian historian: b. Aremark, near Frederikshald, 7 Dec. 1834; d. Christiania May 1893. He was for 20 years an active member of the Storting; was several times minister in the various Radical cabinets; and won several gold medals with his historical essays on ancient Norway. He paid particular attention to the annals of his own country; his best-known works being: 'Norwegian Village Legends' (1870-2); 'Norway's Saints' (1879); 'The Migrations of the Norsemen to Holland and England' (1880); and others in this field.

**Dab**, a popular name given to several species of flatfish (*Pleuronectidae*), which are found on European sea-coasts. The best known of these is the plaice or fluke. This edible fish is covered with small imbricated scales of brown color mottled with orange spots, and averages about two pounds in weight. In London 3,000,000 of them are consumed annually. The American *Pleuronectes* is the common flounder of the northeastern Atlantic coast, of many species, and an excellent table-fish. The habits of all these flatfish are similar. They live on the shallow bottom, and when danger approaches bury their bodies in the mud, leaving only the eyes exposed.

**Dabaiba** (also written Dabaybe, d'Abaibe, etc.), a region lying south of the Gulf of Darien, of which the boundaries were never exactly defined. Spanish adventurers in the 16th century learned, as a matter of common report, that they might find there, or at least by exploring in that general direction, a temple lined with gold; and in this half-true story told by the Indians of Darien we probably have the earliest form of the Eldorado myth. Balboa, when governor on the Isthmus, organized a Dabaiba expedition which he led in person (1512). One hundred and sixty men in two brigantines proceeded up the Atrato River, but made little headway against the hostile natives. Governor Pedrarias Davila (June 1515) sent 200 men under Luis Carrillo and Balboa on the same errand. Attacked by Indians on the Atrato, one half of the soldiers were killed, and the survivors took nothing but news of shameful defeat back to the coast. It seemed that "the mysterious dominion so mysteriously defended must hold great treasure, and in the inflamed minds of the Christians the savage pantheon of Dabaiba had risen into a lofty edifice glittering with gold and gems, and situated in a region rich and beautiful beyond comparison." (H. H. Bancroft.) Subsequently an expedition of 160 men under Tabira and Birues, with light brigantines and canoes, tempted fate upon the river. The savages on this occasion enjoyed more than their usual measure of supernatural protection, for "the divinity of the golden temple" sent a flood which uprooted trees, overturned one of the vessels, and drowned both leaders. Even Francisco Pizarro, who was of the party, shared the superstitious fears inspired by these events to such a degree that he declined to assume command and continue the quest. Peter Martyr speaks of four attempts to gain the golden temple, one expedition attaining a distance up the river of 80 leagues; but "wonderful mischance! — the unarmed and naked people always overcame the armed and armored." Francisco César, captain of infantry, starting from San Sebastian

in 1536, with 80 foot-soldiers and 20 horse penetrated a short way into the mountains, returning with treasure valued at 30,000 castellanos. Pedro de Heredia in the same year led 210 mail-clad men into the sierra, but came back empty-handed. César, repeating his experiment, secured treasure amounting to 40,000 ducats. Next, Badillo led 350 men from Cartagena to explore the same region in 1537. The expedition lasted more than a year, and was a complete failure. One half of the soldiers died; Badillo was ruined and disgraced; César, who accompanied him, lost his life. Such luring by occasional gains, such varied and dire misfortunes seemed the work of enchantment; but a realistic explanation is not far to seek. We know that the territory southeast of the Gulf of Urabá or Darien was subject to a cacique named Dabaybe; his name is still given to a village in the department of Antioquia and to a spur of the Western Cordillera in Colombia. This mountain range for years was an insuperable barrier preventing the isthmian Spaniards from extending their domain overland toward the south. Accordingly their eager search was fruitless, though the temple actually was in existence. The Indian stories described, accurately enough, the splendors of the Inca empire, of Curi-cancha, and Cuzco (see those titles). But the adventurers could not realize, and the Indians themselves probably did not know, how far away the famous temple at Cuzco really was. The facts in the case, the accent of truth in the Indians' accounts, sustained the explorers' confidence year after year; but confident search in a region far removed from the object sought is always "mysteriously" baffling. Long before the report of Pizarro's discoveries in Peru reached the isthmus, a fixed belief had taken possession of the minds of the Spaniards that a kingdom more desirable than any they had despoiled, with gold-adorned temples, was somewhere hidden away in the heart of the continent. The attributes of elusiveness and mystery had become an indispensable part of the conception; therefore the true accounts of the wonderful Temple of the Sun did not exactly tally with the "glittering phantom" of their imagination. After Quesada (see COLOMBIA), starting from Santa Marta, succeeded in penetrating, by way of the Magdalena River, the region of Colombian uplands which lay beyond Dabaiba, naturally the golden temple was sought still further inland; and thus the headwaters of the Orinoco and Amazon were discovered. Bancroft and other writers following his prompting have suggested that an ancient building in the Cenú valley, near which were found tombs containing gold and gems, may have been the temple of Dabaiba; it is quite impossible, however, to accept this conjecture, for the reason that colonists of San Sebastian came upon the Cenú building at an early date, and, if it had been the real object of their search, they would have been able, with the assistance of the natives, to identify it beyond question. See EL Dorado.

MARRION WILCOX.

**Dabajuro**, Venezuela, a township in the district of Buchivacoa, state of Falcón. It includes a village of the same name near which a severe battle occurred 7 June 1822, in the war for the independence of Venezuela; the Royalists under Morales defeating the Republican

forces. The patriots lost 167 men in the battle, and afterward some of the prisoners, including several officers, were shot, in violation of the treaty of Trujillo.

**Dabb, or Palm-lizard**, an agamoid lizard (*Uromastix acanthurus*), common in the sandy deserts of northern Africa and Arabia.

**Dabchick** (*Podilymbus podiceps*), a bird of the family *Podicipidae* (q.v.), and the smallest of the grebes, distinguished by the thick bill and absence of cephalic crests. The total length slightly exceeds one foot; the back is brownish black; the belly silvery gray mottled with dusk, but whiter and more silky in winter; the bill bluish in summer, dull yellow in winter. It ranges and breeds throughout tropical and temperate America. *P. fluviatilis* is a closely similar European species. See GREBE.

**Dabney, Charles William**, American consular officer: b. Alexandria, Va., 19 March 1794; d. Fayal, Azores, 12 March 1871. He was made United States consul in the Azores in 1826, and by his services to the people of the islands made his name a household word among them.

**Dabney, Charles William**, American college president: b. Hampden-Sydney, Va., 19 June 1855. He is a son of R. L. Dabney (q.v.). He was graduated from the University of Virginia in 1877 and pursued later studies at Berlin and Göttingen. In 1887 he became president of the University of Tennessee, and was assistant secretary of agriculture of the United States 1893-7. In 1904 he was elected president of the University of Cincinnati. He has published among other works, 'History of Agricultural Education in America' (1899); 'Agriculture and Education' (1899).

**Dabney, Richard Heath**, American historical writer: b. Memphis, Tenn., 29 March 1860. He was educated at the University of Virginia, and has been a professor of historical and economic science there since 1897. He has published: 'The Causes of the French Revolution' (1888); 'John Randolph: A Character Sketch.'

**Dabney, Robert Lewis**, American Presbyterian clergyman: b. Louisa Co., Va., 5 March 1820; d. 1898. He was a professor in Union Theological Seminary, Virginia, 1853-83, and from 1883 was professor of philosophy in the University of Texas. During the Civil War he served for a time as major in the Confederate army. He published: 'Life of General Thomas J. Jackson' (1864); 'Sacred Rhetoric' (1866); 'Sensualistic Philosophy' (1878).

**Dabney, Virginus**, American author: b. Elmlington, Va., 15 Feb. 1835. His publication of 'The Story of Don Miff, as Told by his Friend, John Bouche Whacker, a Symphony of Life' (1886), reached its fourth edition in six months. He also published: 'Gold that Did not Glitter.'

**Daboia**, *da-boi'a*, the generic name of a venomous serpent of the East Indies, known also as Russell's viper (q.v.).

**Daboll, dā'bōl, Nathan**, American educator and writer: b. about 1750; d. Groton, Conn., 9 March 1818. He wrote the 'Schoolmaster's Assistant' (1799) and the 'Practical Navigator.' He is best known for his share in the universally used 'New England Almanac,' which he began in 1773.

**Daboll, Nathan**, American writer: b. Connecticut 1782; d. 1863. He was son of the preceding, and compiled the 'New England Almanac' begun by his father. He is the author of 'Daboll's New Arithmetick,' long a terror to the American school-boy.

**Da Capo**, *dā kā'pō* (It. 'from the head or beginning'), in music, an expression written at the end of a movement, to acquaint the performer that he is to return to, and end with, the first strain. It is frequently used in the abbreviated form D. C.

**Dacca**, *dāk'a*, or **Dhaka**, *dhā'kā*, India, a commissioner's division in one of the lower provinces of Bengal. It is one of the richest divisions in India, and although containing a good deal of jungle and unoccupied land, produces such quantities of rice as to be called the granary of Bengal. The surface is an uninterrupted flat, and is intersected by two of the largest rivers in the world—the Ganges and Brahmaputra—from whose periodical inundations its extraordinary fertility arises. Dacca was at one time celebrated for its hand-woven muslins, which are of singular delicacy and beauty. This branch of industry, however, is now carried on to a very small extent. The fineness of the yarn or thread used in the making of these muslins is not equal to that in some fabrics of European manufacture, but in durability and delicacy the Dacca muslins excel other muslins. The finest or 'royal muslin' used to be worth about \$5 a yard. For the most delicate varieties only yarns are used that are some years old. Pop. 9,844,127.

**Dacca**, India, city, capital of the district of the same name, and for 80 years, during the 17th century, the capital of Bengal. It is situated on the river called the Boor Gunga (Old Ganges), at the distance of about 150 miles northeast of Calcutta. In this city and vicinity, the celebrated Dacca muslins are still manufactured to a small extent, and jute works have been established in recent years. It has an extensive manufacture of shell bracelets, much worn by the Hindu women. The city was formerly much more extensive than it is at present, and exhibited a degree of splendor to which it has now no pretensions, as the magnificent ruins of bridges, causeways, caravanseries, palaces, gardens, etc., sufficiently prove. Dacca is considered one of the healthiest and most pleasant places in Bengal. In this city is one of the four hospitals for the insane under the Bengal presidency, and a college maintained at the public expense, in which there is an average of about 340 students, mostly Hindus. Pop. (1901) 90,679.

**Dace**, a name rather loosely applied to various species of small fresh-water fishes of the minnow family (*Cyprinidae*), but especially to members of the genus *Leuciscus*, of which 22 North American species are discriminated; others belong to *Rhinichthys*, *Notropis*, and *Semotilus*, those of the latter being also called chubs and roach. *Semotilus atromaculatus*, the horned dace, is one of the best known and largest species, and abounds in the small brooks of the eastern half of the United States. As in many of the other species, the upper surface of the head of the male is ornamented during the breeding season with cutaneous tubercles. Because of their abundance the dace are im-

portant as furnishing food for larger fishes, and some of the larger species are much sought by juvenile anglers. The European dace (*Leuciscus vulgaris*) is common in British rivers, as well as in those of France, Germany, and Italy. It prefers deep, clear streams and swims in shoals. See CYPRINIDÆ.

**Dacelo.** See JACKASS KINGFISHER.

**Dach,** dāh, **Simon,** German lyricist: b. Memel 1605; d. 1659. His numerous hymns and songs are found in various collections, his hymns especially in the 'Scriptural Arias' of Heinrich Albert. His 'Annie of Tharau,' a Low-German lay for the wedding of his friend Parson Portatius with Anna Neander, became a popular favorite; his 'Praise of Friendship' seems to belong to a better age; and his spiritual songs, 'In Thy Control, O Lord,' 'Be Comforted, my Soul,' etc., are hardly surpassed by any compositions of his day.

**D'Ache',** Caran, kă-rāh dāsh. See POIRE, EMMANUEL.

**Dachshund,** dāks'hoont (Ger. *dachs*, badger; *hund*, dog), a breed of small German hounds with very long, cylinder-shaped bodies; short, crooked legs; large heads; long pendant ears; and short, stiff, smooth hair. In color these dogs are black-and-tan, or tan with black ears, the former being the characteristic coloring of the best sort. They were originally used in Germany to hunt badgers, and sometimes even in fox-hunting. Though slow in movement, they are possessed of a keen scent, and great power of endurance, rendering them valuable as hunting-dogs when suitably trained. They are much used by sportsmen on the continent of Europe, but their usefulness is impaired by the difficulty of keeping them under proper command. The dachshund is akin to the old English turnspit, and a similar dog is depicted on the ancient Egyptian monuments.

**Dacia,** dā'shī-ā, in ancient times, a district of uncertain limits to the north of the Danube, inhabited by the Daci or Getæ, afterward a Roman province. It comprised that region now known as Moldavia, Wallachia, and portions of Transylvania and Hungary. For a long time the Daci were formidable enemies of the Romans, and during the reign of the Emperor Domitian obtained so great an advantage that the emperor was compelled to accede to a disgraceful peace. To wipe off this stain Trajan, the second emperor after Domitian, in the year 100 A.D. invaded the Dacian territory, and forced the Dacian king, Decebalus, to accept humiliating terms of peace. These he soon broke; and Trajan entering Dacia a second time, again subdued it, and then erected it into a Roman province, 106 A.D. The Romans remained masters of this province till the reign of the Emperor Aurelian, when, in 274 A.D., they withdrew from the region to the north of the Danube, and assigned to the Roman colonists of Dacia a territory on the south of the Danube lying between Upper and Lower Mœsia, which was hence called Dacia Aureliani. The former Dacia was now successively overrun by the Goths, Huns, Gepidæ, and Avars. Since that time the history of this country, which then lost the name of Dacia, is to be sought for in that of the provinces of which it formerly consisted.

**Dacier, André,** ān'drā dā-sē-ā, French philologist: b. Castres, Upper Languedoc, 6 April 1651; d. 18 Sept. 1722. He studied at Saumur under Tanneguy LeFèvre, whose daughter Anne was associated in his studies. After the death of LeFèvre, in 1672, he went to Paris, and in 1683 he married the daughter of his former teacher. In 1695 Dacier was elected a member of the Academy of Inscriptions and of the French Academy; of the latter he was afterward perpetual secretary. The care of the cabinet in the Louvre was intrusted to him. Besides editions of 'Pompeius Festus' and the 'Œuvres d'Horace, en Latin et en Français, with the Nouveaux Eclaircissements sur les Œuvres d'Horace' (1681-9), and 'The Nouvelle Traduction d'Horace' with critical annotations, he prepared translations of 'Marcus Antoninus,' 'Epictetus,' 'Aristotle's Art of Poetry, with Annotations,' etc.

**Dacier, Anne Lefèvre,** āh lê-fāv, French classical scholar: b. Saumur March 1654; d. Paris 17 Aug. 1720. She was wife of the preceding, and early displayed her learning by an edition of 'Callimachus.' Her learned works were not interrupted by her marriage, which took place in 1683. In her 'Considérations sur les Causes de la Corruption du Goût' she defended Homer with the acuteness of a profound commentator, and Lamotte replied with a great deal of wit and elegance; on which account it was said Lamotte wrote like an ingenious woman, Madame Dacier like a learned man. In her 'Homère Défendu' she showed little mercy to Hardouin, who had written a satirical eulogy of this poet. On this occasion she was said to have uttered more invectives against the reviler of Homer than the poet himself had placed in the mouths of all his heroes. She translated 'Terence' and three pieces of 'Plautus,' in the prologue of which she treats of the origin, the cultivation, and changes of dramatic poetry with acuteness. Her translation of the 'Plutus' and the 'Clouds' of Aristophanes deserves indulgence as the first translation of the Greek comic poet. Her translation of Anacreon and Sappho, with a defense of the latter, met with success. Equally estimable for her character and her talents, she gained as many admirers by her virtue, constancy, and equanimity, as by her works. She was a member of several learned academies.

**Dacite,** an igneous rock of the diorite family, of porphyritic or compact texture, having crystals of plagioclase felspar quartz and biotite in a glassy or finely crystalline-ground mass. The name is derived from the old province of Dacia, now part of Hungary. Dacites grade into andesites by a lessening of the amount of silica, and differ from rhyolites and trachytes in containing plagioclase rather than orthoclase felspar. A typical dacite shows on analysis the constituent acids and bases in about these proportions:  $\text{SiO}_2$  67.2;  $\text{Al}_2\text{O}_3$  17.0;  $\text{Fe}_2\text{O}_3$  3.5;  $\text{FeO}$  1.2;  $\text{CaO}$  4.5;  $\text{MgO}$  1.5;  $\text{Na}_2\text{O}$  3.7;  $\text{K}_2\text{O}$  1.6. Dacites are found at Lassen's Peak, Cal.; in the Yellowstone Park; in the Eureka District, Nev., and elsewhere in the western United States. See DIABASE.

**Dacoits',** bands of robbers in the East, especially in Burma, India, where for years they were the terror of the country until the annexation of Burma by the British in 1886.

**Da Costa**, dā kōs'tā, Izaak, Dutch poet and theologian: b. Amsterdam 14 Jan. 1798; d. Leyden 28 April 1860. Among his works are: 'Prometheus' (1820); 'Poems' (1821-2); 'Gala Songs' (1828); and 'Hagar' (1840).

**Da Costa, Jacob Mendes**, American physician: b. St. Thomas, W. I., 7 Feb. 1833; d. Villanova, Pa., 11 Sept. 1900. He was graduated at Jefferson Medical College in 1852, practising in Philadelphia. In 1863 he became lecturer in Jefferson Medical College, in 1872 professor of the theory and practice of medicine there, and in 1891 professor emeritus. In 1895 he was chosen president of the College of Physicians and Surgeons in Philadelphia. He wrote: 'Harvey and His Discovery'; 'Medical Diagnosis,' etc.

**Dacrocystitis**, dāk-rō-cys-tī'tis, an inflammation in the tear-sac. It may result only in the sub-acute swelling of the tear-sac, or it may become purulent, very much inflamed, swollen and painful, and finally discharge pus. Prompt evacuation by surgical means is the safest and best treatment.

**Dacrydium**, a genus of tall trees, mostly Australian, of the natural order *Taxaceæ*, to which also belong the genera *Podocarpus* and *Taxodium*, important timber and ornamental trees. Several species are of wide utility in ship- and house-building and furniture-making, especially for carved furniture; others yield edible fruits (drupes). A kind of beer is made from the young twigs of some species. The most valued species are probably *D. kirkii*, *D. cupressinum*, and *D. franklinii*, the so-called huon-pine, which is really a yew. They often attain heights of 100 feet and diameters of four feet or more.

**Dacryo'ma**, a disease of the lachrymal duct of the eye, by which the tears are prevented from passing into the nose, and consequently run over the eyelid.

**Dac'tyl**, in Greek and Roman versification, a foot consisting of one long followed by two short syllables. In the following line, for example,

Tityre | tu patu | lae recu | bans sub | tegmine | fagi, the first, second, third, and fifth feet are dactyls. In modern hexameter verse a dactyl is represented by one accented and two unaccented syllables. The word is derived from the Greek *daktylos*, a finger, because a finger has one long and two short joints. See RHYTHM.

**Dactyl'iomancy** (Greek *daktylios*, a ring, and *mantia*, divination), the pretended art of divining by means of finger rings.

**Dac'tylis**, or **Orchard-grass**, a monotypic genus of the grass family (*Gramineæ*) native of Europe and Asia. It is naturalized in America, and cultivated as a fodder plant. The flowers are in rounded compressed spikelets at the end of a one-sided panicle. The fruit is loosely enveloped in the glume. The common orchard grass (*D. glomerata*) is often met with in fields and waste places. It is a coarse grass, little relished by cattle in its wild state, but is acceptable in its cultivated state. It grows from New Brunswick south to South Carolina, westward to Kansas, and north to Manitoba. It is sometimes called cocksfoot-grass. See GRASSES.

**Dactyl'itis**, etymologically, an inflammation of the finger, but generally restricted to an osteomyelitis of the phalanges or metatarsal or metacarpal bones. This may be either tuberculous or syphilitic. In tuberculous form the bone slowly enlarges, the skin becomes reddish, softening takes place, and pus is discharged through a short cavity which leads to dead bone. In its treatment care should be paid to the general condition of the patient. General up-building, by cod-liver oil and other tonics, is necessary. Surgical procedures may be imperative. In the syphilitic form, which usually affects infants, there is as a rule a gummatous deposit in the bones. It resembles the tuberculous forms, but responds to treatment by means of potassium iodide.

**Dadayag**, dā-dā-yāg', the name of a tribe of the Malayan race, who live in the Cagayan mountains in Luzon. The Dadayags are said to have been cannibals. Their speech differs in some respects from that of any other of the 47 tribes of the Malaysians.

**Daddy-long-legs**, a name sometimes substituted for the more appropriate term "crane-fly," to designate the small British dipterous insect of the family of *Tipulidæ*, some groups of which are harmless, and dance in the twilight air, while others are injurious to growing crops. They are true flies, though having long legs. In America the name daddy-long-legs is applied only to the harvest-spider, of the family *Phalangidæ*, which is not a fly. The body is very small when compared with the great length of the legs, which contain over 50 joints each. The legs are thought to be organs of sense as well as of locomotion. This harvestman lives on small insects and is entirely harmless to man.

**Dado**, dā'dō, an architectural term for the middle part of a pedestal, that is to say, the solid rectangular part between the plinth and the cornice; also called the die. In the interior of houses it is applied to a skirting of wood several feet high round the lower part of the walls, or an imitation of this in wall-paper, painting, etc.

**Dadu'chus** (Lat.-Gr., *dadouchos*), literally a torch-bearer, but applied as an epithet to any of the ancient divinities or other personages when they were represented as bearing a torch or flambeau. Daduchi were also those persons who, in the celebration of the Eleusinia at Athens, carried the sacred torches. The daduchus was inferior to the hierophant, and of equal rank with the keryx.

**Dædalion**, dē-dāl'i-ōn, the son of Lucifer, changed, according to the Greek legend, by Apollo into a falcon.

**Dædalus**, dē-dā-lūs or dēd'ā-lūs, mythical Greek sculptor, the scene of most of whose labors is placed in Crete. According to the common accounts Dædalus lived three generations before the Trojan war, was distinguished for his talents in architecture, sculpture, and engraving, and as the inventor of many instruments; for instance, the axe, the saw, the plummet, the auger; also of glue, and masts and yards for ships. As a sculptor he wrought mostly in wood, and was the first who made the eyes of his statues open. He built the famous labyrinth and a temple of Artemus Britomartis in Crete; and executed for Pasiphaë the noto-



## DÆDALUS OF SICYON — DAGHESTAN

rious wooden cow. Being imprisoned with his son Icarus, he invented wings for flying. The wings were fastened on with wax, and Icarus flew so high that the heat of the sun melted the wax, and the wings dropped off, leaving him to fall into the sea, whence the Icarian Sea is said to have received its name. Dædalus himself reached Sicily, on the southern coast of which a place was called, after him, Dædalium. Philologists suppose that Dædalus is not really a proper name, but the common appellation of all the first architects, metallurgists, and sculptors in Grecian antiquity, being derived from or akin to the Greek daidallein, "to work with skill." The mythical Dædalus is sometimes confused with Dædalus of Sicyon.

**Dædalus of Sicyon**, Greek sculptor who lived about 400 B.C. He is said to have been the pupil, and some authorities say the son of Patrocles. The statue 'Trophy,' at Olympia, erected in remembrance of the victory over the Lacedæmonians, was attributed to Dædalus. Other works credited to him are: 'Two Boys using the Strigil'; 'Cowering' or 'Crouching Venus'; and a number of portrait statues of victors in the Olympian games.

**Dæmonelix**, a scientific name provisionally given to an extraordinary formation, apparently fossiliferous, extending over a large area in northeastern Nebraska and eastern Wyoming. The soft sandstone of this region has undergone excessive erosion, leaving fantastic figures, some of them 40 feet high. The objects to which the term is especially applied are of various shapes, including gigantic pillars, lower cake-like forms, and columns appearing like fingers and cigars. Those particularly exciting scientific inquiry are spiral and twisted, giving rise to the local name "Devil's Corkscrew." These in some cases resemble huge hop-poles with definite vines running up spirally, or screws with exactly cut threads. In other cases the corkscrew is closely imitated, leaving the spiral without the central pole. So far as the tests have gone, the composing material is found to contain cellular, non-vascular, parenchymatous tissue—a fibre distinguishing it from its stony matrix, and not to be referred to animal but rather to plant origin, and pointing to the cryptogam group.

**Daendels**, Hermann Wilhelm, hër'män vîl'hêlm dän'dêls, Dutch general: b. Hattem Gelderland, 1762; d. Africa June 1818. He took part in revolutionary disturbances in Holland in 1787, and was in consequence compelled to seek refuge in France. In the campaign of 1793 he rendered important service to Dumouriez, and was elevated to the rank of a general of brigade. In 1806 he took service under the king of Holland, and from 1808 to 1811 he was governor-general of the Dutch East Indian possessions, and published 'Staat der Nederlandsche Oost-Indische Bezittingen' (1808-11). On the overthrow of Napoleon, the new king of Holland, William I., intrusted Daendels with the organization of the Dutch colonies on the coast of Africa, and there he died.

**Dâet**, dâ'ät, Philippines. 1. City of Luzon, in the province of Ambos Camarines, situated between the Dâet River and one of its branches. It is a radiating point of several roads, a port of entry. It was the capital of the Spanish province of Camarines Norte. Pop. 10,650. 2. A river

which enters the sea near the town of the same name.

**Daffodil** (corrupted from the Latin *asphodelus*), the English name of those species of *Narcissus* which have a large bell-shaped corona. The common daffodil (*N. pseudo-narcissus*) is a native of England and of nearly all parts of Europe, growing in woods and hedges, and often cultivated in gardens, where it not unfrequently becomes double. In gardens many varieties of it are among the most esteemed of early flowers.

**Dagami**, dâ-gä'mê, Philippines, town in the province of Leyte, on the Binahaan River, 16 miles south-southwest of Tacloban. Pop. 25,000.

**Däge**, Eduard, êd'ooärd dâ'gê, German historical painter: b. Berlin 10 April 1805; d. there 6 June 1883. He was a pupil of Neiderlich and Wach, finishing his studies in Italy. Besides his religious paintings Däge was remarkable for his genre pictures of small size. His chief works are found in the churches of Rostock and Sigmaringen, and in the chapel of the Château at Berlin. His 'The Old Sacristan' and the 'Discovery of Painting' hang in the National Gallery at Berlin. Among his other works are many altar pieces for churches: 'The Paræ' and 'Woman and Child,' in the Raczyński Gallery in Berlin; 'Initiation of a Nun'; 'Shelter at the Altar'; 'Charitable Monk'; 'Roman Woman and Child.'

**Dagger**, a weapon resembling a short sword, with a two-edged, sometimes three-cornered, sharp-pointed blade. In the feudal period it was carried by knights in addition to their sword; and in single combat it was wielded in the left hand, and used by them to parry the blows of their adversaries, and also to despatch a vanquished opponent, unless he begged for quarter, whence it was called the "dagger of mercy." A kind of dagger known as a dirk was formerly used by the Scottish Highlanders, and is still regarded as an essential part of a Highland costume. The dagger has been regarded as especially the weapon of assassins. In printing, a dagger (†) is often used for the second reference on a page when there is more than one.

**Dagger-moth**, a common name given to both *Acronycta* and *Apatala*, genera of nocturnal moths, which feed upon the leaves of orchard trees and small fruits. *Acronycta* has fore wings varied with dagger-like black marks. *Apatala* has gray fore wings margined with black dots and transverse lines. The caterpillar is of a velvety black color, and is beautiful. It changes into the pupa by wrapping itself in leaves bound with a silken thread.

**Daggett**, Mary Stewart, American writer: b. Morristown, Ohio, 30 May 1856; married Charles Daggett in 1875. She has published: 'Mariposilla' (1895); 'The Broad Isle' (1899).

**Dagh**, a Persian word signifying mountain; hence Daghestan, land of mountains.

**Daghestan**, dâ-gês-tân', Russia, province in the Caucasus, stretching along the west side of the Caspian Sea; area, 11,036 square miles. Its fertile and cultivated valleys produce good crops of grain, silk, cotton, flax, and tobacco.

The inhabitants are chiefly Mohammedans, of Tartar and Circassian origin. Capital is Derbend. Pop. 601,987.

**Dagnan-Bouveret, Pascal Adolphe Jean**, pās-kal ä-dōlf zhōn dān-yān boov-rā, French painter: b. Paris 7 Jan. 1852. He was a pupil of Gérôme, and recipient in 1874 of the second "Grand Prize of Rome." He soon broke with the style of Gérôme and showed the influence of Bastien Lepage. His picture of the death of Manon Lescaut, which took the medal of the third class at the Salon of 1878, showed him to be in possession of an original and particularly individual style of painting. 'A Wedding Party at the Photographer's,' exhibited in the Salon of 1879, was much admired for composition and technique. But this style was too close to caricature and was soon abandoned. In the Salon of 1880 he displayed a much more serious form of talent. His picture 'An Accident,' which took the medal of the first class that year, remains one of his masterpieces, being greatly admired for the truth of its types and expressions. These early works ranked him among the most keen portrayers of our modern manners. 'The Blessing of a Young Couple before Marriage' (1882) bore the stamp of extraordinary poetical feeling which his later paintings, illustrating, for the most part, the life, customs, and costumes of Bretagne, served to accentuate. In his 'Hamlet and the Grave Diggers' the artist is himself represented as the moody Danish prince. Among his best-known works are: 'The Consecrated Bread,' in the Luxembourg; 'The Virgin'; 'The Bretons at the Pardon' (1887); 'The Breton Peasant' (1888); 'The Cemetery of Side Kebir'; 'The Conscripts'; 'The Lord's Supper' (1896), a very great work; 'The Horses at the Watering Trough' and two portraits of de la Rochetaille and Gustave Courtois. Very modern in his taste for individuality, he resembles the great masters in the touching simplicity of his feeling, and the idealism which is evolved from his strong realism and illumines it. See Stranahan, 'History of French Painting' (1899); Van Dyke, 'Modern French Painters' (1896).

**Dago, dāg'é, or Dagden**, Russia, an island included in the government of Esthonia. It is situated to the southwest of the entrance of the Gulf of Finland, and has productive fisheries. The soil is mostly poor, and the coast rocky. The inhabitants include many Swedes. Pop. about 16,000.

**Dag'oba**, in Buddhist countries and those which at one time held the Buddhist faith, a massive erection containing relics. The word is said to be derived from *dā, dātu, or dhātu*, a relic, and *geba or garbha*, the womb. They are built of brick or stone, are circular in form, and are erected on natural or artificial mounds, while the stone or brick structure itself sometimes rises to an immense height. The contents of a dagoba usually consist of stone or metallic vessels of various shapes and sizes. One of the articles is usually a silver casket, with a gold casket, often highly wrought with chased work on the surface and set with precious stones, and this second casket is either enclosed in the first or lying beside it with the rest of the objects. Some of the smaller articles, such as pearls, gold, buttons, rings, beads, etc., are sometimes contained in these caskets, which are in some cases

scratched on the surface with a peculiar character. These dagobas have always been held in the highest veneration by the Buddhists, and a common mode of testifying their veneration is to walk around them, repeating prayers the while. Some remarkable dagobas are to be seen at Anuradhapura, in Ceylon.

**Dagobert** (dāg'ō-bért or dā-gō-bār) I., king of the Franks: b. about 600; d. Epinay 638. In 628 he succeeded his father, Clothaire II., who had acquired the divided members of the Frankish empire. He waged war with success against the Slavonians, Gascons, and Bretons; but stained the splendor of his victories by cruelty, violence, and licentiousness. After he had conquered the Saxons, it is said that he caused all those whose stature exceeded the length of his sword to be put to death. He deserves praise for his improvement of the laws of the Franks. He was buried in St. Denis, which he had founded.

**Dagon**, a deity of the Philistines, whose image is generally believed to have been in the form of a triton or merman, with the upper part human and the extremities, from the waist downward, in the shape of the tail of a fish. From this latter circumstance the name is derived, from the Hebrew *dag*, a fish. Dagon and his temple are mentioned in Scripture, more especially in 1 Sam. v. 4. Milton alludes to him in describing the infernal senate in 'Paradise Lost.'

**Daguerre, Louis Jacques Mandé**, loo-ë zhāk măn-dā dā-gār, French inventor: b. Cormeilles, Seine-et-Oise, 18 Nov. 1789; d. Petit-Brie, near Paris, 10 July 1851. He was at first a scene-painter at Paris, and while engaged in painting panoramic views, he discovered a method of representing moonlight, day and night, changes of season, and so on, by the proper illumination of a large transparent canvas painted on both sides. (See DIORAMA.) The pictures were first exhibited in Paris in 1822. On 19 Aug. 1839 his successful completion of photographic printing was announced to the Academy by Arago. As early as 1814 Nicéphore Niépce had directed his attention to photography, and in 1827 had delivered pictures on metal to the Royal Society. In 1826 he had been joined by Daguerre, and on 14 Dec. 1829 a formal agreement was made between them. Niépce died 5 July 1833, and had apparently before his death given up the hope of succeeding with a plate sensitized by iodine. Daguerre, however, persevered, and at length produced the method which has been since called daguerreotype. See DAGUERREOTYPE PROCESS.

**Daguerreotype** (da-ger'-ō-tip) Process, one of the earliest methods known for fixing the image afforded by the camera, and thus producing permanent pictures, or "photographs." As practised by Daguerre, the method consists in exposing a silver plate to the action of iodine vapor until a sufficient coating of iodide of silver is produced upon it, and then allowing the image in the camera to fall upon it for a time varying from three minutes to an hour or more, according to the nature of the subject and the intensity of the light. The plate is then submitted to the action of the vapor of mercury, which condenses most upon the parts where the light has acted most, and in this way greatly increases the distinctness

of the image. The plate, after development by mercury vapor in this way, is immersed in a solution of hyposulphite of soda, which dissolves those parts of the iodide that have not been affected by light, and thus renders the picture permanent. Daguerre made the details of his process public in 1839, and for this he was awarded a pension by the French government. Important improvements in the method were soon made. The iodide of silver is so feebly sensitive to light that Daguerre, in his public demonstration of 17 Sept. 1839 gave his picture an exposure of 1 hour and 12 minutes. In December 1839, before the first French photograph by the iodine process had been received in the United States, Dr. Paul Beck Goddard of Philadelphia discovered that iodine could be advantageously replaced by bromine, an element discovered by Balard 13 years before. By the use of bromine, the sensitiveness of the plate was increased so greatly that Dr. Goddard obtained some practically instantaneous views. The earlier method had been tried for portraiture, but, owing to the great exposures required, the results were described by a newspaper of the time (and no doubt with reason) as "most terrific facsimiles of the human visage." Upon the substitution of bromine for iodine, or the use of bromine in conjunction with iodine, the exposures were reduced to more reasonable lengths, and the pictures that were obtained were much less "terrific." Early in 1840 Robert Cornelius, of Philadelphia, fitted up a room exclusively for portraiture, and this was the first photographic studio in the world. The expensive silver plates were afterward replaced by plates of copper that had been heavily electroplated with silver, and a method of toning the pictures by the use of chloride of gold was also devised. Daguerre was associated, in his experimental work, with Nicéphore Niépce, who had previously discovered the bitumen process (q.v.) of taking photographs; and many authorities maintain that Daguerre took unfair advantage of his partner, and published, as his own, processes for which Niépce should have had equal credit. However this may be, it is certain that Niépce died in 1833, some years before Daguerre produced any pictures by the method that now bears his name; and it would appear that Daguerre is at least entitled to the sole credit for the discovery of mercury as a developing agent. The way in which this discovery came about is of deep interest, and as the legend was cited by Professor Liebig as one of the finest examples of the inductive method of reasoning, it may perhaps be received with some degree of confidence in its authenticity. Daguerre had discovered that iodide of silver is affected by light, and he had repeatedly iodized silver plates and exposed them in his camera, with the result that feeble images were obtained. He was filled with hope that some way might be found to intensify these images, but he worked for years without success, and Niépce died with a feeling of regret that they had wasted so much time upon a method that was apparently incapable of yielding the results that they sought. On one occasion, after the death of Niépce, Daguerre removed one of his old plates from a closet in which it had been stored, and was about to repolish it and use it over again in a new experiment, when he observed that the view to which it had been previously exposed,

and which showed but faintly when he had put the plate away, was now strong and clear. Without disturbing anything in the closet, he prepared a new plate, sensitized and exposed it as before, and placed it in the closet for a similar time. The same intensification of the image was observed. He concluded that the developing agent that he had sought so indefatigably was present in his closet, but he had no idea what it could be. To identify it, he prepared and exposed plate after plate, each time leaving the plate where the first one had stood, but each time removing one article from the closet. The pictures still developed, even when the last thing had been apparently removed. He found, however, that some mercury had been spilled in the closet, and being driven to the conclusion that this was the mysterious agent sought, he tried it, and his mercury-development process was the result.

**Dagun**, a god worshipped in Pegu. According to Indian mythology, when Kiakiak destroyed the world, Dagun reconstructed it.

**Dagupan**, dā-goo-pān', Philippines, a town in the province of Pangasinan, Luzon, situated on the Lingayen River where it enters the gulf of the same name, about 130 miles northwest of Manila, on the Manila & Dagupan Railroad. It is an important road centre, and has a large trade. It was one of the strongholds of the Filipino insurgents and the point where most of the filibustering expeditions landed. Soon after hostilities between the United States and the insurgents opened, the American military authorities were unanimous in the opinion that Dagupan should be made a base of operations, but sufficient troops were lacking till November 1899, when an expedition left Manila for this place under command of Gen. Wheaton. A landing from the transports, supported by a number of naval vessels, was made at Lingayen, a suburb of Dagupan, which has a sheltered harbor and had hastily constructed earthworks. The works and town were shelled, but there was no response from shore. As the American troops were being landed in steam launches a long line of insurgents suddenly appeared among the sand dunes and fired upon the troops. The Americans returned the fire, completed their landing, and drove the insurgents out of Dagupan, and then started on a march to the east and south in the expectation of surrounding Aguinaldo at Tarlac, where he had established his headquarters.

**Dahabieh**, dā-hā-bē'ē, a barge-like boat used on the Nile for conveyance of travelers. It varies considerably in size, has one or two masts, with a very long slanting yard on each mast supporting a triangular or lateen sail, and accommodates from two to eight passengers. Wealthy travelers often hire one of these vessels for a trip up and down the river, the voyage to the First Cataract and back, under the most favorable circumstances, occupying seven weeks, and three weeks more if prolonged to the Second Cataract.

**Dahl, Johann Kristen Clausen**, yō'hān krīs'ten klow'sēn dāl, Norwegian landscape painter: b. Bergen, Norway, 24 Feb. 1778; d. Dresden, 14 Oct. 1857. His talent displayed itself early and he studied at the Academy of Copenhagen 1811-18. He then went to Dresden, where from 1821 onward, he was professor of

painting in the Art Academy. Among his works are: 'Storm at Sea' (1823); 'Winter Landscape.' He was a prolific painter and his works are found in many European galleries. See Aubert, 'Maleren Professor Dahl' (1892-4).

**Dahl, Konrad Neuman Hjelm, kōn'rād noi'mán hyēlm**, Norwegian poet and novelist: b. Drontheim 24 June 1843. He is author of a series of stories and novels of Norwegian and Lapp life, with much insight into nature and into the heart of the people. Most notable among them are: 'The Finnish Youth' (1873); 'The Lion' (1874); 'Eda Mansika' (1875); 'The Voyager in the Icy Sea' (1878).

**Dahl, Michael**, Swedish painter: b. Stockholm, Sweden, 1658; d. London, England, 20 Oct. 1743. He was taught painting by Ernststræen Blocker; later studied in France and Italy; and settled in London in 1688, where he had a very successful career. During the reign of Queen Anne and George I. he acquired an extensive patronage among the nobility and at court. His coloring is good and the accessories are rendered honestly, though in rather a tasteless style. He did not display either originality or genius, but was content to portray his patrons as he found them.

**Dahlak, dā-lāk'**, a group of three islands, with many smaller rocks, in the Red Sea, off the Bay of Massowah. They were famous in Roman times for their pearl-fisheries, but the beds have long since been exhausted and abandoned. The inhabitants number about 1,500, and are under the rule of a sheik holding authority from Egypt. They carry on a trade with the Arabian coast.

**Dahlgren, dāl'grën, Fredrik August**, Swedish poet and dramatist: b. Nordmark 20 Aug. 1816; d. 1895. He wrote many dialect songs and ballads, collections of which were published in three volumes (1876). These have attained an extraordinary degree of popularity. Of his dramas many have been very successful; his 'Vermlandingarne,' a musical drama (1846), had more than 100 consecutive representations. He translated a great many dramas from foreign languages, and wrote a history of the Swedish stage.

**Dahlgren, dāl'grën, John Adolf**, American naval commander: b. Philadelphia, Pa., 13 Nov. 1809; d. Washington, D. C., 1870. In 1826 he entered the navy of the United States as a midshipman, in 1837 was advanced to the rank of lieutenant, and in 1855 to that of commander. From the year 1847 he was employed on ordnance duty, and invented the cannons which are called after him Dahlgren guns, besides contriving a more effective method of arming gunboats with 12 to 24 pounder howitzers, throwing canister-shot and shrapnel-shells. At the outbreak of the Civil War he was commander of the naval station at Washington; in July 1862 he undertook the supreme command of the South Atlantic squadron; and after the death of Admiral Foote in 1863 was appointed to the command of the fleet stationed before Charleston. He is the author of 'Thirty-Two Pound Practice for Ranges' (1850); 'Systems of Boat Armament in the United States Navy' (1852); 'Naval Percussion Locks and Primers' (1852); 'Ordnance Memoranda' (1853); and 'Shells and Shell-guns' (1856). Consult 'Mémorial of John A. Dahlgren' (1882).

**Dahlgren, dāl'grën, Karl Fredrik**, Swedish poet and humorist: b. Stens-Bruk, East Gothland, 20 June 1791; d. Stockholm 2 May 1844. He excelled in descriptions of nature and in the idyllic burlesque. Many of his songs and ballads have a permanent place in the treasury of Swedish popular songs. For years he published a 'Muses' Almanac,' containing his stories and comic sketches. His novel 'Nahum Fredrik Bergström's Chronicle' (1831) is a work of distinguished merit.

**Dahlgren, dāl'grën, Madeleine Vinton**, American author: wife of Rear-Admiral Dahlgren; b. Gallipolis, Ohio, about 1835; d. Washington, D. C., 28 May 1898. She was married in 1865 to J. A. Dahlgren (q.v.). Her works include: 'Idealities' (1859); 'South Sea Sketches' (1881); 'Etiquette of Social Life in Washington' (1881); 'Memoirs of John A. Dahlgren' (1882); 'The Lost Name'; and 'Lights and Shadows of a Life' (1886). For her Spanish translation of Donoso Cortes' 'Catholicism, Liberalism, and Socialism,' she received the thanks of Pius IX.

**Dahlgren, Ulric**, American military and naval officer: b. Bucks County, Pa., 1842; d. 4 March 1864. He was a son of Rear-Admiral J. A. Dahlgren (q.v.). At the outbreak of the Civil War he became aide, first to his father and later to Gen. Sigel, and was Sigel's chief of artillery at the second battle of Bull Run. He distinguished himself in an attack on Fredericksburg and at the battle of Chancellorsville, and on the retreat of the Confederates from Gettysburg he led the charge into Hagerstown. He lost his life in a raid undertaken for the purpose of releasing national prisoners at Libby prison and Belle Isle.

**Dahlgren Gun** (named from Rear-Admiral John A. Dahlgren), a gun in which the front portion is materially lightened and the metal transferred to the rear, giving the "bottle-shape," which caused some surprise on its first appearance in Europe. Col. Bomford, chief of ordnance of the United States army, began making this experiment previous to the War of 1812, and gave the name of "Columbiad" to the piece.

**Dahlia, dā'li-a**, a genus of perennial herbs of the natural order *Compositæ*, closely related to the genera *Bidens*, *Coreopsis*, and *Cosmos* (q.v.), which are distinguished by technical characters. Indeed, *Cosmos diversifolius*, or black cosmos, is well known to American gardeners as *Bidens* and *Dahlia*. The true dahlias are much confused as to nomenclature, only about 10 well-authenticated species being recognized out of a large number of synonyms. With few exceptions (Central American species) they are natives of Mexico. Six species are cultivated, but only one of these (*D. variabilis*) and its apparent sub-species, *D. juarezii*, are of wide horticultural importance. The former has given rise to several thousand horticultural varieties since 1814, when well-marked double varieties first appeared; the latter, which was introduced about 1870, has produced a considerable number popularly known as cactus dahlias. There are also many single varieties. Considering the short time the dahlias have been in cultivation (since 1879) they have attained a very high rank as a garden plant, being numbered among a dozen plants to have special societies and

exhibitions, both in Europe and America. Besides the cactus forms, which are less formal than the earlier double varieties, there are many forms and sizes ranging in color from white to yellow and deep red, but deficient in the shades of blue.

The plants may be propagated by seeds for obtaining new varieties, by division of the underground parts, or commercially, by cuttings. They succeed well in almost any good soil, the tubers or the young plants being set in beds as soon as danger from frost is past. When frost has killed the tops in the autumn the plants are dug and the tubers stored in a cool, dry cellar until spring, or until they are needed for obtaining cuttings, when they are placed on greenhouse benches and forced. Few pests attack the plants.

Consult: Bull. No. 47, Missouri Experiment Station; Peacock, 'The Dahlia,' and other literature mentioned in article 'Dahlia' by Bailey in 'Cyclopedia of American Horticulture' (New York 1900-2).

**Dahlin**, dā'līn, a white substance, also called inulin, obtained from the pounded tubers of the dahlia. The juice is pressed from the tubers, clarified by standing, mixed with an equal bulk of strong alcohol, filtered, and then with two other volumes of alcohol. Inulin precipitates, and is washed and dried. It is a white starchy powder, with distinct crystalline character; it has no taste or smell, is hygroscopic, but sparingly soluble in water, until it passes into a non-crystalline modification. The tubers pounded and distilled with water yield a strongly smelling, sweetish ethereal oil, which is heavier than water, but becomes buttery and semi-crystalline in it. The tubers also contain a fixed oil and salts of organic acids. The coloring matter of the purple dahlia is very sensitive to acids, which turn it red, and to alkalis, which turn it green. When extracted by water or alcohol, and paper steeped in it, it forms Georgina paper, and is used as a chemical test instead of red and blue litmus paper.

**Dahlmann**, Friedrich Christoph, frēd'rīh krīs'tōf dāl'mān, German historian: b. Wismar 13 May 1785; d. Bonn, Prussia, 5 Dec. 1860. He studied at Copenhagen and Halle; in 1812 was appointed professor extraordinary of history at Kiel, and in 1829 accepted a call to fill the chair of political science in the university of Göttingen. There he continued his historical studies, but did not on that account altogether abandon the domain of politics. He contributed in great measure to the establishment of the constitution of Hanover in 1833, and was a vigorous advocate of liberal principles. In 1842 he was appointed to the chair of history in the university of Bonn, where he gave himself up entirely to literary pursuits. The revolution of 1848 recalled him to public life. He was sent as a deputy to the diet of the confederation, had a share in elaborating the constitution called that of the "Seventeen," and became one of the chiefs of the constitutional or parliamentary party. He was afterward a member of the Prussian chamber of deputies, in which he set himself to withstand the reactionary movement which followed the troubled period of 1848-9; but finally renounced politics entirely, and devoted the remainder of his life to literature. He left a large number

of works, all characterized by great depth, an accurate understanding of the events he relates, and a thorough knowledge of men. Among these are his 'Quellenkunde der deutschen Geschichte' (1830); 'Geschichte Dänemarks' (1840-3); 'Geschichte der englischen Revolution' (1844); and 'Geschichte der französischen Revolution' (1845). See Springer, 'F. C. Dahlmann' (1870-2).

**Dahlonga**, dā-lōn'ē-ga, Ga., county-seat of Lumpkin County, about 20 miles north by west of Gainesville, on one of the branches of the Chattahoochee River, among the foothills south of the Blue Ridge Mountains. It is the seat of the Georgia Agricultural College. The town is the centre of the richest gold mining region east of the Mississippi River. The town was first settled in 1831 by gold miners. The principal industries are those connected with the mining and refining of gold. Pop. (1900) 1,255.

**Dahn**, dān, Julius Sophus Felix, German historian: b. Hamburg 9 Feb. 1834. He was professor of jurisprudence successively in the universities of Munich, Würzburg, Königsberg, and Breslau. Among his historical works are 'The Kings of the Germans' (1861-71); 'Geschichte der deutschen Urzeit' (1883-8). He is the author of many treatises on the jurisprudence of the ancient Germans, and the civil and criminal law and procedure of modern German states. He has also written epics and lyrics. Of the former may be named 'Herald and Theano' (1856); of the lyrics, 'Ballads and Songs' (1878). He is author also of the dramas: 'König Roderich'; 'Sühne'; etc., as well as several romances.

**Dahomey**, dā-hō'mī or -mā (native name of the people, *Dauma* or *Dahomé*), a French protectorate in western Africa, bounded on the east by the British possessions of Nigeria and Lagos, on the south by the Gulf of Guinea, on the west by Togoland (German), and on the north by the French military possessions; area about 60,000 square miles, having been increased in 1900 by territory in the north, adjacent to the Niger. The coast line is only about 70 miles in length. About midway on the coast lagoon is the port of Whydah, whence a road extends inland to Abomey, a distance of 65 miles. Dense forests and dismal swamps cover nearly two thirds of this distance, but from the Great Swamp of Agrimé vast undulating plains rise for many miles in the direction of the Kong Mountains. The Avon and Denham lagoons receive the rivers, which are not very important. The soil is extremely fertile. Among native trees are the baobab and the cocoanut palm. Groves of oil-palms encircle each town, and palm-oil is made in large quantities. Maize, beans, and peas, as well as cassava, yams, sweet potatoes, limes, oranges, pineapples, and other tropical fruits grow in luxuriance; cotton, sugar, and spices of all kinds are also grown, and sheep, goats, swine, and poultry are raised, though not in large numbers.

In 1901 the imports, which consisted chiefly of liquors, tobacco, and cotton goods, were valued at \$3,150,130; and the exports, which were chiefly palm-oil and palm kernels, \$2,095,763. Some cotton cloth is made in the country, and weapons and tools are forged from native iron. There are few roads in the country.



## DAIBUTSU—DAIRY CATTLE

In 1902 a railway was constructed from the port of Kotonu into the interior. A telegraph line connects that port with Abomey, the Niger and the Senegal. There were 950 miles of telegraph and 100 of telephone line in 1903. The currency consists of cowrie shells and French, English, and American coins. The colony is administered by a lieutenant-governor with an administrative council.

**Daibutsu**, dī-boo'tsoo, the name given in Japan to a gigantic statue of Buddha. The largest Daibutsu in the empire is found at Nara (q.v.). It is 53 feet high and supposed to date from the 8th century. The image is shired in a pagoda. At Kamakura (q.v.) is a bronze Daibutsu over 49½ feet in height. The eyes, which are four feet long, are made of gold.

**Daillé, Jean**, zhōñ dā-yā, French Protestant theologian: b. Châtelherault 6 Jan. 1594; d. Charenton, near Paris, 15 April 1670. He became pastor in 1625 of the church at Saumur, and in 1626 of that of Charenton at Paris, where he passed the remainder of his life. He was one of the ablest and most learned divines of his day, and did essential service to the Protestant cause by several works, among which the most celebrated is entitled 'Traité de l'emploi des SS. Pères pour le Jugement des Différends de la Religion' (1632). It was also published in Latin and translated into English, and in both forms has had a very extensive circulation both in England and on the continent. It aims to show that the authority of the fathers has been far too much overvalued, and that the ignorance or inaccuracy apparent in almost all their works unfit them for the establishment of any doctrine not clearly laid down in Scripture. He also wrote distinct treatises on several of the leading points of controversy between Protestants and Roman Catholics.

**Daimiel**, dī-mē-ēl', Spain, town in the province of Ciudad Real; about 20 miles east-northeast of the town of Ciudad Real on the Azuer River. It is well built; the principal edifices are two parish churches, the one Gothic, the other Doric, and both surmounted by towers. The manufactures consist chiefly of linen and woolen fabrics, and lace, and the trade is chiefly in grain, cattle, wine, and wool. Pop. 11,850.

**Daimios**, dī-mē-ōz, a class of feudal lords formerly existing in Japan, but now deprived of their privileges and jurisdiction. As long as their feudal possessions remained to them, they exercised in their own domains the rights of petty rulers, and 18 of them were to all intents and purposes independent; a circumstance which greatly limited the power of the mikado, and formed a hindrance to the career of progress and reform on which Japan had entered. In order to centralize the power of the government, a decree was issued on 12 Aug. 1871 by which the daimios were deprived of all rights of sovereignty, their districts incorporated with the imperial territories, and their troops handed over to the imperial government. At the same time a new constitution and organization were given to the state. A deliberative assembly, consisting of two chambers, was created, to which deputies were sent by the former feudal governments or districts of the daimios (Han); and the daimios themselves were made official governors of those districts which they previously held as feudal rulers, and were placed

upon a salary hereditary in their families. The yearly sum allotted to the payment of their salaries is equal to one tenth of their former income.

**Dair-el-Kamar**, dīr-ēl-kā'mār, Syria, the chief town of the Druses, on a slope of Mount Lebanon, 12 miles southeast of Beirut. It is accessible only by two narrow paths. It was once a flourishing place, with important manufactures of gold and scarlet cloth, but it is now greatly decayed. The only remarkable buildings are a large khan, a palace which formed the old serai of the emir of Lebanon, a Maronite convent, and several churches. Pop. 8,000.

**Daircell, Saint**, said to have lived in Kerry, Ireland, in the 7th century. The legend is that he was the illegitimate son of a husbandman, and that the mother sought to kill the child at birth. A fluttering white dove, which seemed to descend from heaven, stayed her hand, and saved the life of the babe. The legend says further that the dove covered the child with its wings, "gathered him to her in her wings," whence the name, Daircell, "a gathering."

**Dairy Cattle**, the name given to the neat cattle raised for their milk, rather than for their flesh, the latter being called beef cattle. Man has, by careful attention, prolonged the natural period of milk-flow and increased the quantity much beyond the needs of the calf. This is drawn from the cow by the milking process familiar to most people; and the value of the cattle depends upon the quantity and richness of the milk produced, more than upon any other feature. Naturally, however, the more robust breeds, and those that can do well on comparatively coarse food, are most useful in certain sections of country subject to extremes of temperature, and producing inferior fodder-grass.

Though dairy cattle are bred almost all over the civilized world, the stock of the best breeds comes from the British Isles, Holland, and Switzerland, the two last named countries being justly famous for their rich milk and fine cheese.

In America, almost all breeds of cattle are represented, and experiments have been made and statistics gathered under the supervision of government, as to the breeds that thrive best in the various agricultural districts. According to the reports of the United States Department of Agriculture these are the Brown Swiss, which, as its name signifies, is of Swiss origin; the Dutch Belted, and Holsteins, two breeds from Holland; and the Ayrshire, Devon, Guernsey, Jersey, and various breeds of Durham from Great Britain.

Dairy cattle are usually somewhat less heavy than beef cattle; and, except in rare cases, are extremely gentle. They should be well cared for, and kept in as cleanly a manner as possible, as such care is fully repaid by both the amount and condition of the milk produced.

The Brown Swiss is a breed of medium size, fleshy, well-proportioned, with a straight, broad back, heavy legs and neck, and a somewhat coarse appearance. Despite this, however, these cattle are rather small-boned, have fine silky coats, and rich elastic skin. The color is brown, shading into a soft mouse color, or dun, on the body, with head, neck, and legs very dark, often almost black. The nose, tongue, hoofs, and switch are quite black. There is a light-colored stripe around lips and nostrils, a tuft of light

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hair between the horns, and a similarly colored stripe along the tail. The eyes are full, gentle, very bright, and usually black. The small horns are white, tipped with black, and curve forward and inward. The ears are good-sized, and round, and lined with light-colored, silky hair. The udder is large, and quite white. The average weight is from 1,200 to 1,400 pounds, the bulls sometimes attaining greater size and weight. Both bulls and cows are hardy and active, and, owing to their origin, thrive well in mountainous regions. The bulls are just as docile as the cows, and even in big herds, are easily managed.

The Dutch Belted are gentle, vigorous cattle, with rather longer legs and less bulky bodies than other breeds, and are easily known by the broad belt of white encircling the body, between hips and shoulder blades, forming a marked contrast to the jet-black, glossy coat of the remainder of the body. No white should appear on the black portion, and on the white belt there should be no black spot.

The second Dutch breed, the Holstein-Friesian, is characterized by great size, and by the black-and-white coat. The ground-color is usually jet-black, of a silken texture, with marks of pure white upon it. These do not merge gradually into the black, but are clearly outlined patches. The horns are small, usually white, tipped with black. The tail is tipped with a white brush. Though the largest and heaviest of dairy cattle, the Holsteins are not so easily satisfied with coarse food, nor so hardy as many other breeds; and they are large feeders.

The British breeds are varied. The Ayrshire is the breed best suited to rugged uplands, pastures, and inclement weather. These cattle, generally under the average in weight, are short-legged, small-boned, and alert. The horns are gracefully curved, generally upward; the eyes are unusually bright. The color is red and white in spots; the red sometimes varying to a rich brown. The coat is always glossy; and the intelligence, economy, and large yield of milk make this a favorite breed.

The Devon, considered the most beautiful of dairy breeds, is a red-coated, smooth-skinned animal, active, hardy, symmetrical, and intelligent. Though the typical red may vary in tone, being sometimes pale, sometimes dark, no markings of white or black appear, save one patch of white on and in front of the udder. The females have beautiful, creamy, black-tipped, pointed horns, curving upward. The males have shorter, thicker, and less graceful horns.

Guernseys, as their name signifies, originated in the island of Guernsey in the English Channel. They are yellowish in color, often with patches of white on the body and legs. The ground color is deepened almost to brown in many cases. The horns are small, fine, and graceful, often yellowish from the base. This breed secretes a large amount of yellow coloring-matter, noticeable in the animals themselves, and very prominent in the golden color of the butter made from their milk. Guernseys are nervous, and yet with care may be kept quite gentle.

The Jerseys, from the same group of islands as the former breed, are smaller than any other breed of dairy cattle. In color these animals are rather variable, ranging through shades of brown to black, yellow, tan, or cream, either

solid color, or broken, patches often being white. The horns are small and crumpled, the eyes soft and gentle. Jerseys are much less fleshy than most other breeds, and are sharper in outline. They are light, quick, and rather graceful in motion; and are second only to Guernseys in the richness and color of their milk. There is an unmistakable, though indefinable, air of breeding about a Jersey that invariably shows.

The Durham cattle are of various breeds. They are all short-horned or quite hornless; are red in color, sometimes marked with white; have heavy bodies, and short, broad heads. They are usually classed as beef cattle; but are so capable of giving good milk in large quantities that they are often bred for dairy purposes. They are exceedingly docile, even the great bulls, which attain a weight of 2,500 to 3,000 pounds, being thoroughly domesticated.

**Dairy Industry, American.** Compared with other farming and agricultural industries in the United States, dairying is one of considerable import and shows great development during the last two or three decades. The industry is most prominent in sections where natural advantages are the greatest. According to government statistics, the leading dairy States are Vermont, Connecticut, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, and Minnesota. Butter is made in all these States, while New York, Wisconsin, and Ohio are the heaviest producers of cheese, the varieties including imitations of many foreign cheeses. Dairy farms are rapidly developing in sections where wheat and other "general" crops have become unprofitable. The industry has recently made great advances in North and South Dakota, Nebraska, Kansas, Missouri, and the Pacific Coast States, also in the Southern States where only a few years ago it was hardly known. The old belief, that dairy operations could be carried on only within narrow limits, comprising those few States wherein the industry originated in this country, exists no longer. It has been proved that cows can be kept and good butter and cheese can be made in almost any district where suitable coarse fodder can be produced. It is often possible to grow more abundant and better fodder crops than are furnished by the natural grasses. Well or cistern water may take the place of the flowing spring. Freight rates and fast refrigerator-car transportation lines have the effect of placing the distant dairyman near the markets where grains can be purchased and his products can be disposed of to the best advantage. Dairying seems to be the one branch of agriculture least affected by conditions of soil and climate.

Dairying has many advantages over other kinds of farming. It improves the land instead of wearing it out, because the products of the dairy which leave the farm permanently are not rich in plant food, as is the case with field crops, and it provides fertilizer in the form of manure which is of immense value for enriching poor soil. It furnishes a profitable way of using certain farm products, such as grass and straw, that otherwise would be valueless. It provides a cheap by-product in the form of skimmed milk or whey, which can be very profitably fed to calves and other animals. It can be combined

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with other forms of agriculture. Perhaps best of all, it engages the farmer in paying work for the entire year. It is for these reasons that the general appearance of any section where dairying is extensively followed, is one of thrift and progress. The growth of the dairy industry is sometimes checked temporarily by unfavorable economic conditions, such as high cost of feeds and high prices of beef, as well as by overproduction of dairy products.

The United States census for 1900 gives the following dairy statistics:

Cows on farms and ranges.....	17,139,674
Cows in towns and cities.....	973,933
Total cows in the United States.....	18,112,707
Total milk produced, gallons.....	7,728,583,350
Butter made on farms, pounds.....	1,071,745,127
Butter made in creameries and urban establishments, pounds.....	420,954,016
Total butter, pounds.....	1,492,699,143
Cheese made on farms, pounds.....	16,372,330
Cheese made in factories and urban establishments, pounds.....	282,332,774
Total cheese, pounds.....	299,006,818
Creameries and cheese factories, number..	9,355
Average annual yield of milk, per cow, gallons.....	424
Alvord's estimates for 1903 are as follows:	
Number of cows producing milk to be used,—	
For milk, cream and condensed milk.....	6,400,000
For making butter (15½ pounds each per year).....	10,900,000
For making cheese (35½ pounds each per year).....	840,000
For rearing calves.....	860,000
Total cows, estimated.....	19,000,000

The aggregate annual value of dairy products is estimated to exceed \$500,000,000. Exports of dairy products have always been small, as the great market for them is at home. The demands of foreign markets differ somewhat from domestic requirements, and as the latter are observed almost universally by makers of butter and cheese, an explanation is thus furnished of the fact that these products do not enjoy the highest reputation abroad. That butter and cheese which will fully satisfy foreign tastes can be supplied from this country has been proved many times by experience of exporters as well as by trial shipments made by the Department of Agriculture. There are great possibilities for American dairy products in other countries, and these will be developed as soon as our production is permanently in excess of our needs. During recent years the annual exports of butter have seldom exceeded 25,000,000 pounds, and those of cheese 75,000,000 pounds. The quantities and values exported (principally to Great Britain) in the fiscal year 1902 were: Butter, 16,002,169 pounds; value, \$2,885,609; cheese, 27,203,184 pounds; value, \$2,745,597. Through the efforts of a few American manufacturers of condensed milk an excellent grade of this article is rapidly becoming established in the world's markets. The value of condensed milk exported in the fiscal year 1902 was \$1,473,564.

The best and most profitable breed of dairy cattle has as yet never been agreed upon. Each of about half a dozen different breeds has strong claims to highest merit and each has its enthusiastic advocates. The latter are often influenced

by conditions which have no economic importance. Different breeds differ markedly in certain characteristics such as size, color, and disposition, as well as quantity and quality of milk. As a general rule, when a large amount of milk is given, it is low in fat-content or "richness." Interesting data regarding several leading dairy breeds of cattle have been compiled by Woll as follows:

BREED	Cows included	Lactation periods	Average yield per lactation period		Average fat	Average cost of		
			Milk	Butt'r fat		Food eaten per day	Producing 100 lbs. milk	Producing 1 lb. of fat
	No.	No.	Lbs.	Lbs.	Per c't.	Cts	Cts	Cts
Ayrshire.....	10	20	6,909	248.5	3.60	14.5	78.5	21.5
Devon.....	5	5	3,684	183.3	4.60	10.3	94.0	20.5
Guernsey.....	10	10	6,210	322.9	5.20	13.5	82.8	15.8
Holst'n-Fries'n....	9	10	8,215	282.0	3.43	17.2	74.7	21.5
Jersey.....	9	18	5,579	301.1	5.40	13.9	94.7	17.4
Shorthorn.....	4	5	8,696	345.4	3.97	14.3	78.7	19.4

There is a wide variation in the milk production of different cows of any breed. Yields of milk amounting to 10,000 pounds (two and one seventh pounds to one quart) in one year are not rare. They are exceeded even by some Jerseys and Guernseys, whose milk is always of high quality. Records of over 20,000 pounds are credited to Holsteins, whose milk tests considerably lower in fat. The great majority of dairy cows throughout the country are "grades," that is, their blood represents different breeds and in no definite proportions. As producers of milk, individual grade cows can be selected that will equal thoroughbred animals, but the latter are more satisfactory for breeding purposes. Farrington reports a high grade Shorthorn cow in Wisconsin that gave in one year 11,131.7 pounds of milk containing 500 pounds of fat, an equivalent of 584 pounds of butter. The total feed consumed in the year cost \$39.60. The total value of her butter and skimmed milk was \$131.83. The cost of feed consumed for every pound of butter produced was only 6.7 cents. Too often the value of the annual product of a cow is very low,—even less than \$25.00. It is a fact that on account of lack of business methods many such cows are kept at an actual loss to their owners.

Dairymen are divided upon the question as to the merits of the "single-purpose" and "dual-purpose" animals. The latter include those that can be profitably disposed of for beef when their period of usefulness in the dairy is ended. Advocates of the former think this advantage is purchased at a high cost and that the single-purpose cows are enough more profitable while in the dairy herd to permit of their final disposition at a low figure.

Milk of the cow is secreted in the mammary glands known as the udder. Wing thus well describes the udder of a good cow: "It should be large and well developed; it should occupy the whole space between the hind legs, extending well up between the thighs and well forward upon the belly. It should be held firmly against the wall of the abdomen. It should be level or nearly so on the bottom, and the four quarters should be as nearly as possible equally developed and each furnished with a cylindrical perpendic-



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ular teat of moderate length. The whole organ should diminish rapidly in size, as the milk is withdrawn. The hair upon the udder should be fairly abundant, fine and soft, and abundantly supplied with brownish dandruff." As milk is a product of the blood, the importance of an ample blood supply to the udder, a vigorous constitution and a strong circulation is readily seen. It is highly important to withdraw the milk from the udder regularly, quietly and completely if the flow is to be maintained.

Van Slyke gives the average of 5,552 American analyses of cow's milk as follows:

Water	Total Solids	Fat	Casein	Albumin	Sugar	Ash
87.10	12.90	3.90	2.50	0.70	5.10	0.70

In addition to the constituents named, certain others are present in minute quantities. The average specific gravity of milk is 1.032. The composition of milk of different cows varies between wide limits. The same may be true of the product of any individual cow from day to day. The New York Agricultural Experiment Station is authority for the following averages of analyses of milks from cows of different breeds:

BREED	No. Analyses	Water	Total Solids	Solids not fat	Fat	Casein	Milk Sugar	Ash	Nitrogen	Daily Milk Yield
Ayrshire.....	252	86.95	13.06	9.35	3.57	3.43	5.33	0.698	0.543	18.40
Devon.....	72	86.26	13.77	9.60	4.15	3.76	5.07	.760	.595	12.65
Guernsey.....	112	85.39	14.60	9.47	5.12	3.61	5.11	.753	.570	16.
Holst'n-Fries'n.	132	87.62	12.39	9.07	3.46	3.39	4.84	.735	.540	22.65
Jersey.....	238	84.60	15.40	9.80	5.61	3.91	5.15	.743	.618	14.07

Koenig gives the variations of milk constituents in about 800 samples as follows:

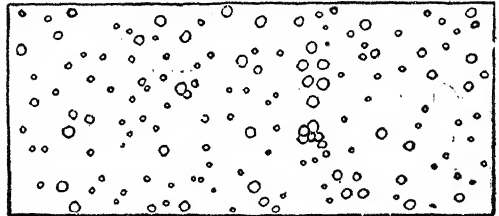
	Maximum	Minimum
Water .....	90.69	80.32
Fat .....	6.47	1.67
Casein .....	4.23	1.79
Albumin .....	1.44	.25
Sugar .....	6.03	2.11
Ash .....	1.21	.35

In some instances American analyses have found even wider variations.

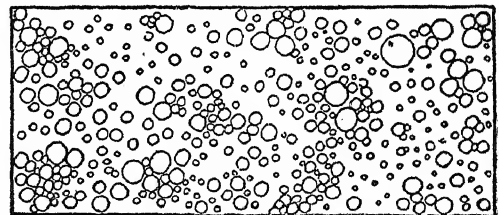
The most variable constituent of milk is fat. By it the "richness" of milk is judged and the commercial value is determined. Milk fat is a complex mixture containing several glycerine compounds. It is present in the form of minute globules suspended in the remaining or watery portion called the serum. The globules average about one ten thousandth of an inch in diameter and are plainly visible under a high power microscope. About 150,000,000 of them are contained in a single drop of milk. Some conditions affecting fat-content of milk have already been mentioned. There are a few others of importance. From about the middle to the last of the period of lactation, the fat in milk slightly increases. The percentage of fat increases gradually from the first to the last of any milking; the first milk drawn contains about 1 per cent fat and the last as high as 9 or 10 per cent. It is popularly supposed that the feed given a cow has a decided influence on the quality of her milk. As a matter of fact, the milk of a cow in normal condition is little affected in this manner. Feed has a much greater influence upon the quantity of milk than its quality. Casein and albumin are proteid or nitrogen constituents of milk. The former is coagulated by rennet or acid, the latter by heat. Coagulated casein or "curd" enters largely into the composition of cheese. Casein is said to be in a state of

"pseudo-solution" in milk. Milk sugar or lactose is in solution in milk. When separated it resembles powdered sugar. It is less sweet than cane sugar and is used to a considerable extent in druggists' preparations and in certain proprietary foods. The mineral matter in milk, called ash or salts, is the part remaining when milk is evaporated to dryness and burned. It includes phosphorus, potassium, calcium, chlorine, magnesium, sodium, sulphur, and iron. Certain gases and other constituents are present in milk in minute quantities.

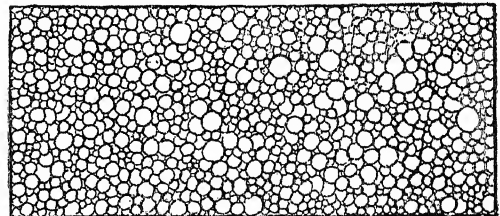
a. Skimmed milk.



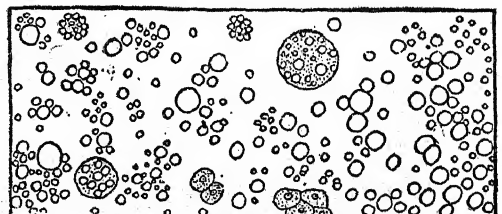
b. Milk.



c. Cream.



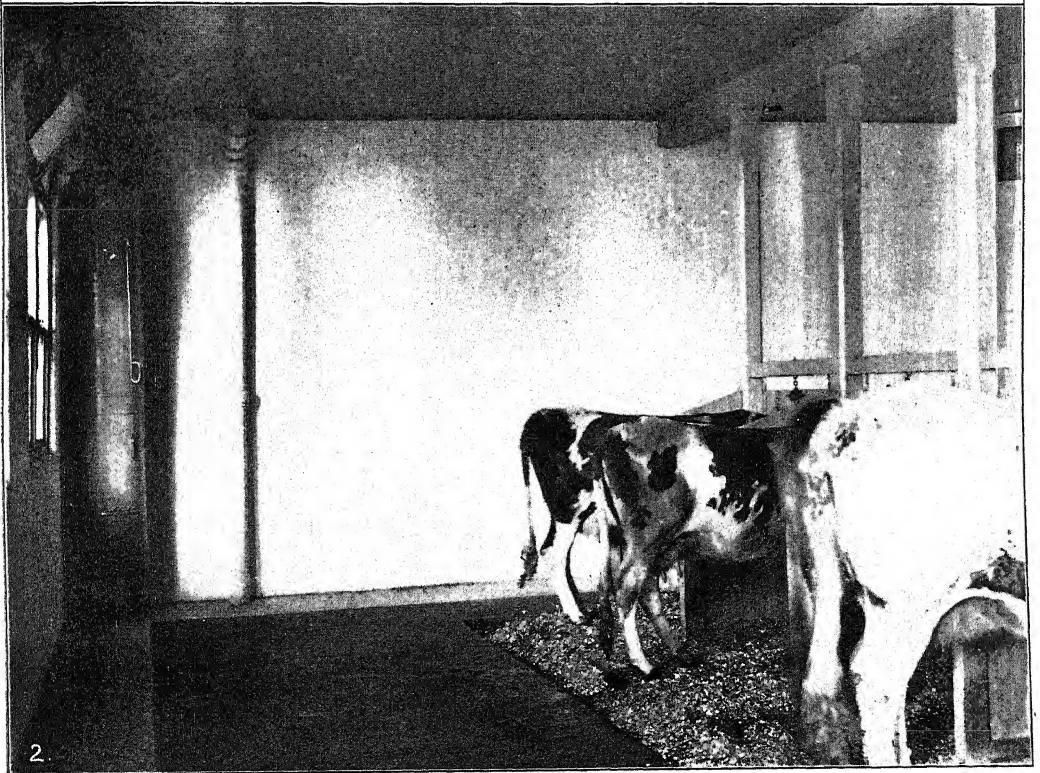
d. Colostrum.



Different grades of milk. (Magnified 300 times.)

The first milk given after parturition is called colostrum. It differs in composition from nor-

DAIRY STABLES.



1. Stalls in a Modern Sanitary Cow Stable.

2. Cows in a Model Sanitary Stable.



## DAIRY INDUSTRY

mal milk, and is fit only as food for the newly born calf.

The only precise method of determining the quality of milk is by a complete gravimetric analysis, but for practical purposes the knowledge of the specific gravity of milk and its fat-content is usually sufficient. The specific gravity can be quickly ascertained by the use of a lactometer, and the fat-content can be more or less accurately determined in a few minutes' time by any one of several quick tests. Of these the one in most general use and the most satisfactory is the Babcock test invented by Dr. S. M. Babcock of the University of Wisconsin. A definite amount of milk is mixed with sulphuric acid in a special bottle having a graduated neck. This is rapidly whirled in a machine and the fat is separated from the rest of the mixture by centrifugal force. By the addition of water the fat is brought up into the neck of the bottle, where its exact percentage can be read. Simple tests have been devised for determining the acidity of milk, and whether or not it has been heated.

Milk is a very delicate product and is subject to taints and changes in great number. It readily absorbs strong odors with which it comes in contact, and it is easily given objectionable flavors when the cows are allowed to eat certain foods within a few hours before milking. The flavors caused by garlic and rag-weed are well known; rape and green rye are claimed to produce bad flavors in the milk when they are fed in certain conditions. Flavors due to the causes named are most noticeable when the milk is first drawn from the udder, and may be largely reduced by aëration or the exposure of milk to the air. When held, milk undergoes many different kinds of changes. The most common is souring, but it may become slimy or "ropy," curdle without souring, become "soapy," turn to a red, blue, or other color, develop peculiar and disagreeable odors, form poisonous products, or become altered in other ways. Most of these changes are directly due to bacteria, but some are caused by enzymes or unorganized ferments. Bacteria find in milk an exceptionally favorable medium for growth. There are so many ways by which they enter that it is a practical impossibility to produce milk which is germ-free. But the character and number of the bacteria that get into milk and their development are largely controllable and have much to do with the success or failure of all operations with milk and its products. Many species of bacteria found in milk are perfectly harmless. Some are essential to certain dairy operations, for example, when it is desired to ripen cream to make butter, lactic acid bacteria are needed; they produce lactic acid from milk sugar and cause the milk or cream to sour. Other species have their peculiar effects in the ripening processes of the various forms of cheese. Numerous varieties of bacteria are objectionable and some are dangerous. The latter include pathogenic bacteria and other forms that may be the direct or indirect cause of disease to the consumer. Well authenticated cases are on record of typhoid fever, diphtheria, and other disease germs being carried by milk and there seems to be proof that tuberculosis is sometimes spread in this manner.

The number of bacteria ordinarily found in milk varies from a few thousand to more than a million per cubic centimetre. Most of the

organisms entering milk are carried there by particles of dust, dirt, and foreign matter that fall into the milk from the attendants' hands and clothes, from the hairy coat of the cow and from the dust-laden atmosphere. Another fruitful source of contamination is furnished by milk utensils that have not been thoroughly cleaned. Bacteria thrive best at temperatures between 80 and 100° F. They grow slowly when the temperature is below 60° and there is very little development at temperatures below 45° F. Different methods of reducing bacteria in milk by removing them or killing them are in use. But these methods are only means for somewhat improving undesirable conditions which should have been prevented. When the bacterial content of milk is high because it contains considerable dirt, it can be somewhat reduced by filtering the milk through sand, cotton, or felt, or by passing it through a separator and recombining the streams of cream and skimmed milk. Certain chemicals of a disinfectant nature are sometimes put into milk for the purpose of destroying germ life. They are known as preservatives and the ones most commonly employed are salicylic acid, boracic acid, and formalin. Their use is highly objectionable and in some States and cities they are prohibited by law. Without doubt they inhibit the growth of bacteria, but there are reasons for believing they also reduce the food value of the milk. To a limited extent and for special requirements, milk is sterilized before use. Sterilization means the destruction of *all* germ life, and to accomplish this the milk must be heated to a high degree, sometimes above the boiling point, the exact temperature depending upon the resisting power of spores that happen to be present and the time of exposure. Or it must be treated by a method of intermittent heating, which is objected to on account of the successive heatings and coolings and the amount of work involved. It is generally believed that the digestibility and food value of milk are greatly reduced by subjecting it to high heat. The pasteurization of milk, by which most of the germs are destroyed by exposure to a comparatively low degree of heat, is favored by many authorities, especially when good, clean milk of low bacterial content cannot be secured. Exposure to 150° F. for 30 minutes followed by rapid and thorough cooling is a common practice. There is no definite rule about degree of heat and length of exposure, but the greater the heat and the longer the time, the more germs are destroyed. It is claimed that bacteria can be reduced from many thousand to less than one hundred per cubic centimetre by holding the milk at 156° F. for 30 minutes. Of course the keeping quality would thus be much improved. At about the temperature last named the milk albumin is coagulated and a cooked taste is acquired, hence that degree of heat is rarely exceeded in commercial work. The pasteurization of market milk is not a general practice, but it is gradually increasing. One of the chief objections to pasteurized milk may be stated. It is known that when several species of bacteria are growing in the same medium, some may retard or prevent the growth of others. When milk is heated and the more numerous forms of bacteria are killed a chance *may* be given to some dangerous form not affected by the degree of heat used, to multiply rapidly without restriction and thus to cause serious

## DAIRY INDUSTRY

results. When cream is pasteurized it becomes thin in appearance, but its "body" can be restored by the use of a lime preparation called "viscogen."

The successful management of a dairy requires great intelligence, patience, and persistence, and no person should expect to succeed in this business unless he has a decided liking for it. Of course the matter requiring first attention is the location of the farm. The elevation and conformation of the land should be such that good air and drainage would obtain. There should be an abundant supply of pure water. For this purpose a well-protected spring or deep well is best and care should be taken to have it located distant from buildings and other possible sources of contamination. Barns and dairy buildings should stand on elevated ground and they should be isolated from other structures. It is well to store all forage in a building separate from the cow stable. By a system of overhead tracks and suspended cars, feed can be easily brought to the herd and manure economically removed. Unless the manure can be spread at once upon the land, it should be stored under a roof. The stable should be planned to facilitate the work of caring for the herd. Light and fresh air are necessary and should be admitted in abundance. It is generally advised that there be allowed at least one cubic foot of space for every pound of live weight. Where the winters are not too cold and expense of construction must be kept low, the cows may be allowed to stand on the ground, the floor of the barn being made from hard packed clay or earth. Better floors are made from planks treated with tar and laid close together. A cement floor is the best, but because of its hardness an abundance of bedding must be used. The stalls should be from three and a half to four feet wide and just long enough so that when the cow is standing, the manure gutter will be immediately back of the hind feet. Many devices for tying cows have been proposed, but one of the most satisfactory is the stanchion attached above and below by a few links of chain, so as to allow some freedom of motion in all directions. A separate feeding box for each animal is objectionable because of the difficulty of keeping it clean. At many of the best dairies the cows are fed on the floor, a long shallow trough in front of the stalls being constructed for this purpose. Provision should be made for frequent access to water. Milch cows should be allowed to go out doors every pleasant day for exercise.

The selection of cows for a dairy herd, regardless of the breed chosen, should be based upon individual merit. Small and unprofitable producers as well as unhealthy cows and those of weak constitution should be avoided, and when they are found in the herd, advantage should be taken of the first opportunity to displace them. It is well said "the bull is half the herd." When calves are to be raised, as is the rule in most dairies, the influence of the bull upon the development of the herd is readily seen. If possible a bull of proved excellence should be used. It is always well to give special attention to the breeding of the bull and attach considerable importance to the performances of his dam and grand-dams. The quantity of milk given by each cow, and its fat test, should be recorded at least one day every two weeks for the purpose of showing which animals

of the herd are profitable and which are not. The time for breeding cows depends upon the requirements for milk. Formerly it was the general practice in dairies not supplying milk for retail sale to have cows calve in the spring and be "dry" throughout the winter. At the present time, however, a large number of dairies are operated most profitably during the winter for the purpose of supplying milk for butter and cheese making, as well as for consumption in towns and cities.

Feeding for best results is a subject which requires much study and experience. Especially is this the case where winter dairying is practiced. In the first place feed should be wholesome and palatable. Then care should be taken to have the nitrogenous and non-nitrogenous components properly proportioned. Just what feeds will be used depends largely upon local conditions, cost, availability, etc. Practical rations as fed in different parts of the country and reported by Woll are as follows: New York, 20 pounds hay, 2 pounds wheat bran, 2 pounds cotton-seed meal, 2 pounds hominy meal. Vermont, 30 pounds corn silage, 10 pounds hay, 4.2 pounds corn meal, 4.2 pounds wheat bran, 8 pounds linseed meal. Wisconsin, 26 pounds corn silage, 10 pounds clover hay, 5 pounds timothy hay, 8 pounds wheat middlings, 1½ pounds oil meal. Most coarse fodders are low in nitrogenous component or protein; of these, the leguminous plants contain the highest percentages of protein. The concentrated feeding stuffs commonly used and containing the most protein, are cotton-seed meal, linseed meal, gluten meal, dried brewer's grains, wheat middlings, and wheat bran.

Changes in methods of feeding which are especially marked at the present time include the growing use of ensilage and the increasing practice of "soiling" or cutting green feeds of different kinds and bringing these to the animals instead of allowing them to graze.

Milk should be produced and handled in such a manner as to keep bacterial contamination as low as possible. The practical way of accomplishing this is to observe the utmost cleanliness in all the stages of production, to cool the milk at least to 45° F. promptly after it is drawn and to hold it continuously at such low temperature. As pathogenic or disease-producing bacteria are the most dangerous of all forms ever found in milk, special care should be taken to exclude them. For this purpose it is necessary to give close attention to the health of the animals and all persons having to do with the herd or the milk. Serious outbreaks of disease have been due to the handling of milk by persons suffering only mildly with a contagious disease such as typhoid fever or who have been exposed to the disease. Dairy cows should be examined at least three times every year by a competent veterinarian; some of the best dairies have examinations more often. The milk of a cow suspected of being out of condition or not in good health should not be used. By far the largest number of bacteria that enter milk are carried by small particles of foreign matter, such as manure, dust, dirt, hairs, etc. Of course these are most abundant in illy-kept barns where milkers as well as the cows and their surroundings are allowed to be unclean. Barns should be kept thoroughly clean. The use of pine shavings for bedding contributes much to

## DAIRY INDUSTRY

cleanliness and they are now found in many of the best dairies. Barns should be so constructed and the work should be so planned that there would be no occasion for unnecessary dust in the atmosphere at the time of milking. Milch cows should be "groomed" daily, and udders should always be cleaned just before milking, with the aid of a brush and a damp cloth. As bacteria are liable to be especially numerous in the milk nearest the teat opening, it is a good practice to discard the first few streams drawn. The operation of milking should be performed in a quiet manner. Freeman has shown that the milk drawn by a man who violently agitates the udder may contain 10 times as many bacteria as that drawn by a quiet milker. Milk should not be used until the fourth or fifth day after calving. In addition to being in good health and avoiding exposure to contagion, the attendants in a dairy should be personally clean. Too often this important matter is overlooked and milk is considerably infected by germs from dirty garments and dirty hands. A special clean suit should be put on and hands should always be thoroughly cleaned before milking. The practice of "wet" milking is extremely filthy. All dairy utensils should

lower surface. The usual cooling device serves also as an aërotator and consists of an apparatus made of thin metal and so arranged that cold water is on one side while the milk being cooled passes over the other. By certain forms of coolers, it is found entirely practicable to quickly bring the temperature of the milk to within 2 to 4° of the temperature of the water. After cooling, milk should be placed in cans or jars, as may be required, and held at a low temperature continuously until used. Recently it has become the practice in a few places and to a limited extent to put milk intended for consumption into glass jars and seal it within a few minutes after it is taken from the cow, and then cool it. This seems to be satisfactory when the milk is exceptionally pure and in no need of aëration. When milk is to be used for butter and cheese making it is not necessary for it to be held at so low a temperature as when it is to be used for retail trade, for the reason that the development of a certain amount of acidity is desirable. This is fortunate for dairymen who happen to have neither cold springs nor ice. Their milk may be delivered to the butter and cheese factory while perfectly fresh, but as high as 80° F., and yet be used in the manufacture of the best butter or cheese.

Items that need to be kept in mind and conditions which should be observed in the management of a first-class dairy are summarized in 'Fifty Dairy Rules' composed by the writer and issued by the United States Department of Agriculture, as follows:

### FIFTY DAIRY RULES.

#### THE OWNER AND HIS HELPERS.

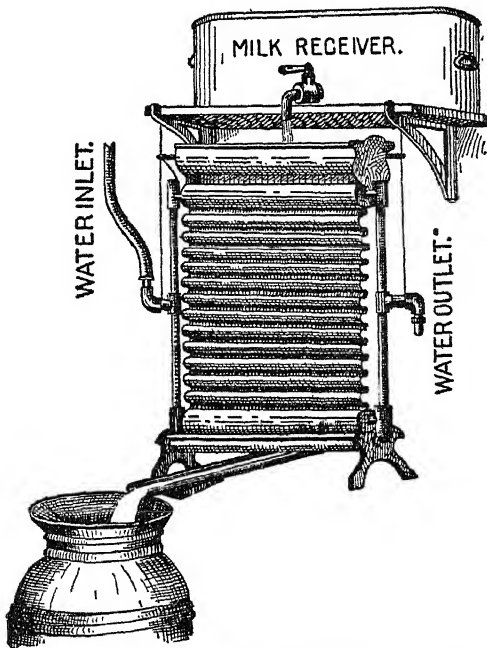
1. Read current dairy literature and keep posted on new ideas.
2. Observe and enforce the utmost cleanliness about the cattle, their attendants, the stable, the dairy, and all utensils.
3. A person suffering from any disease, or who has been exposed to a contagious disease, must remain away from the cows and the milk.

#### THE STABLE.

4. Keep dairy cattle in a room or building by themselves. It is preferable to have no cellar below and no storage loft above.
5. Stables should be well ventilated, lighted, and drained; should have tight floors and walls and be plainly constructed.
6. Never use musty or dirty litter.
7. Allow no strong smelling material in the stable for any length of time. Store the manure under cover outside the cow stable and remove it to a distance as often as practicable.
8. Whitewash the stable once or twice a year; use land plaster in the manure gutters daily.
9. Use no dry, dusty feed just previous to milking; if fodder is dusty, sprinkle it before it is fed.
10. Clean and thoroughly air the stable before milking; in hot weather sprinkle the floor.
11. Keep the stable and dairy room in good condition, and then insist that the dairy, factory, or place where the milk goes be kept equally well.

#### THE COWS.

12. Have the herd examined at least twice a year by a skilled veterinarian.
13. Promptly remove from the herd any animal suspected of being in bad health, and reject her milk. Never add an animal to the herd until certain it is free from disease, especially tuberculosis.
14. Do not move cows faster than a comfortable walk while on the way to place of milking or feeding.
15. Never allow the cows to be excited by hard driving, abuse, loud talking, or unnecessary disturbance; do not expose them to cold or storms.
16. Do not change the feed suddenly.



Milk cooler and aërotator for use with running water.

be simply constructed and easily cleanable. They should not be made of any open or porous material such as wood. Immediately after use they should be cleaned and then sterilized by boiling water, or better, steam. Milk should be promptly removed from the stable, strained, cooled, and cold-stored. It should be handled in a room specially fitted for the purpose,—fresh, clean, and light. A good form of strainer is provided with the usual wire gauze of fine mesh and a double thickness of sterile cheese cloth filled between with pure white sterile cotton. The cloth and cotton should be changed as often as they commence to show dirt near the



## DAIRY INDUSTRY

17. Feed liberally, and use only fresh, palatable feed-stuffs; in no case should decomposed or moldy material be used.
18. Provide water in abundance, easy of access, and always pure; fresh, but not too cold.
19. Salt should always be accessible.
20. Do not allow any strong flavored food, like silage, turnips, cabbage, and garlic, to be eaten, except immediately after milking.
21. Clean the entire body of the cow daily. If hair in the region of the udder is not easily kept clean it should be clipped.
22. Do not use the milk within 20 days before calving, nor for 3 to 5 days afterward.

### MILKING.

23. The milker should be clean in all respects; he should not use tobacco; he should wash and dry his hands just before milking.
24. The milker should wear a clean outer garment, used only when milking, and kept in a clean place at other times.
25. Brush the udder and surrounding parts just before milking, and wipe them with a clean, damp cloth or sponge.
26. Milk quietly, quickly, cleanly, and thoroughly. Cows do not like unnecessary noise or delay. Commence milking at exactly the same hour every morning and evening, and milk the cows in the same order.
27. Throw away (but not on the floor, better in the gutter) the first few streams from each teat; this milk is very watery and of little value, but it may injure the rest.
28. If in any milking a part of the milk is bloody or stringy or unnatural in appearance, the whole mess should be rejected.
29. Milk with dry hands; never allow the hands to come in contact with the milk.
30. Do not allow dogs, cats, or loafers to be around at milking time.
31. If any accident occurs by which a pail full or partly full of milk becomes dirty, do not try to remedy this by straining, but reject all this milk and rinse the pail.
32. Weigh and record the milk given by each cow, and take a sample morning and night, at least once a week, for testing by the fat test.

### CARE OF MILK.

33. Remove the milk of every cow at once from the stable to a clean, dry room, where the air is pure and sweet. Do not allow cans to remain in stables while they are being filled.
34. Strain the milk through a metal gauze and a flannel cloth or layer of cotton as soon as it is drawn.
35. Aerate and cool the milk as soon as strained. If an apparatus for ailing and cooling at the same time is not at hand, the milk should be aired first. This must be done in pure air, and it should then be cooled to 45 degrees if the milk is for shipment, or to 60 degrees if for home use or delivery to a factory.
36. Never close a can containing warm milk which has not been aerated.
37. If cover is left off the can, a piece of cloth or mosquito netting should be used to keep out insects.
38. If milk is stored, it should be held in tanks of fresh, cold water (renewed daily), in a clean, dry, cold room. Unless it is desired to remove cream, it should be stirred with a tin stirrer often enough to prevent forming a thick cream layer.
39. Keep the night milk under shelter so rain cannot get into the cans. In warm weather hold it in a tank of fresh cold water.
40. Never mix fresh warm milk with that which has been cooled.
41. Do not allow the milk to freeze.
42. Under no circumstances should anything be added to milk to prevent its souring. Cleanliness and cold are the only preventives needed.
43. All milk should be in good condition when delivered. This may make it necessary to deliver twice a day during the hottest weather.
44. When cans are hauled far they should be full, and carried in a spring wagon.
45. In hot weather cover the cans, when moved in a wagon, with a clean wet blanket or canvas.

### THE UTENSILS.

46. Milk utensils for farm use should be made of metal and have all joints smoothly soldered. Never allow them to become rusty or rough inside.

47. Do not haul waste products back to the farm in the same cans used for delivering milk. When this is unavoidable, insist that the skimmed milk or whey tank be kept clean.
48. Cans used for the return of skimmed milk or whey should be emptied and cleaned as soon as they arrive at the farm.
49. Clean all dairy utensils by first thoroughly rinsing then in warm water; then clean inside and out with a brush and hot water in which a cleaning material is dissolved; then rinse and lastly sterilize by boiling water or steam. Use pure water only.
50. After cleaning, keep utensils inverted, in pure air, and in as much sunlight as possible, until wanted for use.

Milk is a food of great value. Next to bread and water it is used more commonly than any other article of food or drink. It contains in easily digestible form the four kinds of nutrients required by the body,—protein, fats, carbohydrates and mineral matter. With few exceptions it contains more nutritive matter than can be obtained at the same cost in any other food. Jordan has shown the economy of using milk in the family dietary. The increased use of good wholesome milk is strongly recommended. Skimmed milk also contains considerable food value and could well be used as a human food much more than is the present custom. The average amount of milk consumed daily in cities and towns is about one half pint per capita and to supply this there must be within easy reach one cow for about every 12 persons. Many cows are kept within corporate limits and their product is delivered twice daily,—often "warm from the cow." For best results it should be cooled promptly, but it is generally used before any considerable change takes place. Most of the milk supply of small and medium-sized towns and a large portion of the milk used in cities is taken from the dairy to the consumer by teams, and the general rule is to serve in the morning the product of the same morning and previous evening.

The bulk of the milk used in large cities is transported by special trains and sometimes these originate as far as 200 to 300 miles from their destination. "Train" milk varies from 12 to 48 hours old when delivered to the consumer. Most of it is either 24 or 36 hours old. Producers, dealers, and shippers have learned that milk so long delayed must receive good care, and it often happens that this milk is finally delivered in better condition than milk less old, but neglected. The receipts of milk in New York city are over 1,335,000 quarts daily, and practically all is brought by trains. Milk is usually transported in heavy tin cans holding  $8\frac{1}{2}$ , 20, 30, or 40 quarts. In recent years bottles have come into use and they are gradually increasing in favor. Some concerns maintain bottling stations near the producing farms, and their product is shipped in glass jars which are packed in cracked ice during hot weather. Much milk is bottled in the cities before delivery.

Farmers usually receive two to three cents per quart for their milk in the summer and one cent more in the winter. City retail prices range from 6 to 10 cents per quart. Most milk is delivered promptly after it reaches the city. When it must be held before delivery a clean, cold place must be provided for this purpose. The best results with milk in cans or bottles is obtained when these are stored in tanks of ice water. Cream cans should be buried in cracked ice. If the products are thoroughly cold they may be held satisfactorily in cold, dry air.

Much is being done by State and municipal governments to improve market milk, but the greatest influence to this end that can be produced is a determined demand on the part of the consumers for pure milk and a willingness to pay for it. Medical milk commissions in a few cities are entitled to credit for good results already obtained. In New York and Philadelphia several concerns are distributing milk which is produced and handled under the supervision of commissions of physicians. These concerns are pioneers and deserving of great credit. It is their aim to produce milk in a scientific manner and to take every reasonable measure to insure its purity. One of them operates in 16 different cities and conducts dairies which are models in cleanliness and management. The same company has developed a large trade in "modified milk," which is milk altered in its composition according to the peculiar requirements of infants and invalids, and specially prepared upon physicians' prescriptions. The comparatively few high-class dairies now in operation are doing much to stimulate a wholesome interest in the subject.

Kumiss is one of the forms of fermented milk used as a beverage. It is produced with the aid of yeast.

The principal American publications on dairying, exclusive of butter and cheese, include the following: Wing, 'Milk and Its Products' (1897); Conn, 'Dairy Bacteriology' (1903); Farrington and Woll, 'Testing Milk and Its Products' (1897); Grotenfelt, 'Principles of Modern Dairy Practice' (1894); Freeman, 'Low Temperature Pasteurization of Milk' (1896); Jones, 'Dairying for Profit' (1894); Monrad, 'Pasteurization and Milk Preservation' (1895); Russell, 'Outlines of Dairy Bacteriology' (1894); Snyder, 'The Chemistry of Dairying' (1897); also 'Hoard's Dairymen,' weekly periodical and bulletins issued by the Department of Agriculture and by experiment stations in the several dairy States.

RAYMOND A. PEARSON,  
*Gen. Mgr. of the Walker-Gordon Laboratory Co.*

**Dais**, dā'is, a platform or raised floor at the upper end of an ancient dining-hall, where the high table stood; also a seat with a high wainscot back, and sometimes with a canopy, for those who sat at the high table. The word is also sometimes applied to the high table itself.

**Daisy**, the popular English name of a plant of the genus *Bellis* of the natural order *Composita*. Properly the name belongs to the English daisy (*B. perennis*). This is a native of Europe and Asia, and is one of the most common of the flowers of England. In the United States the English daisy is generally found in gardens, but it has escaped in some cases, and may be found growing in waste places or on lawns from Nova Scotia through New England and southern New York to eastern Pennsylvania. It has been naturalized in California and British Columbia. One species of the true daisy, the western daisy (*B. integrifolia*), is a rare plant found in moist soil from Kentucky and Tennessee to Arkansas and Texas. The flowers generally called daisies in the United States belong to the chrysanthemum family, although some asters are also given the common name.

**Daisy Miller**, a novelette by Henry James, published in 1878. From the constant incongruity between the Miller social standards and the Draconian code of behavior of the older European communities, come both the motive and the plot of the story.

**Dak**, dāk, or **Dawk**, a Hindu word used in India for the mail or post; a relay of men, as for carrying letters, despatches, etc., or travelers in palanquins. The route is divided into stages, and each bearer, or set of bearers, serves only for a single stage. A dak-bungalow is a house at the end of the stage designed for those who journey by palanquin.

**Dakar**, dā-kār', Senegal, a port furnishing one of the best harbors on the west coast of Africa. It is situated near Cape Verde. There is a railroad between the port and the capital, Saint Louis. Dakar is a fortified military post. Pop. (1902) 12,000.

**Dako'ta**, or **Dakotah**, a tribe of North American Indians, constituting at one time an important element in the great Sioux group. They were reported numerous in the 17th and 18th centuries, and roamed over extensive hunting grounds in parts of the present States of North Dakota and South Dakota. The tribe consisted of six sub-tribes: (1) Santee; (2) Sisseton; (3) Yankton; (4) Wahpeton; (5) Yanktonnai; (6) Teton. These sub-tribes were divided into bands or groups; as, the Tetons consisted of the Brulé, Blackfeet, and other groups. The Dakotas were fond of war and when not fighting against outsiders would sometimes fight among themselves. In 1658 they had 30 towns on the Mississippi, the Missouri, and Saint Croix. The old war spirit has not died out; in 1862 a portion of the tribe attacked the whites and killed about 1,200. In 1890-1 the whites feared another uprising when the ghost-dance took place at the Pine Ridge agency. The Dakotas are located in the United States, chiefly in North and South Dakota, Nebraska, and Montana. There are about 900 in Canada, and in the United States about 2,800. See INDIAN SCHOOLS; RESERVATIONS; SIOUAN.

**Dakota**. See NORTH DAKOTA; SOUTH DAKOTA.

**Dakota River**. See JAMES RIVER.

**Dakota Stage**, one of the formations of the Upper Cretaceous series in the United States. The rocks, mostly conglomerates and sandstones, cover a vast area extending over the Great Plains from Texas northward into Canada. Their origin is still a matter of speculation, since they are not marine; and in Texas lie unconformably upon the Comanche limestone. West of the Rocky Mountain uplift the Dakota rocks are more fine-grained, and include beds of coal or lignite of workable thickness. In much of the Rocky Mountain region the Dakota rests conformably upon Lower Cretaceous and even Jurassic strata. The exact equivalent of the Dakota stage along the eastern border of the United States is undetermined. The lower cross timber sand of Georgia and Mississippi is probably equivalent to the Dakota. See CRETACEOUS SYSTEM.

**Daksha**, dāk'shā, in Hindu mythology, a priest to whom Siva gave a ram's head out of revenge, because he did not invite the god to his grand sacrifice.



**Dal**, *däl*, a Swedish word signifying, like the German *Thal*, valley, as in *Dalcarlia*.

**Dalaguete**, *dä-lä-gä'tä*, Philippines, a town on the southeast coast of Cebú, 44 miles southwest of the town of Cebú. Trade in the products raised in the interior is carried on with the adjacent islands. In two years the population increased about 2,000. The town would be of more importance as a port of entry, but it has little or no protection from the northeast monsoons and from the south winds. Pop. 21,825.

**Dalberg**, *däl'bërg*, **Karl Theodor**, Prince and Archbishop of Mayence, chancellor of the empire, and elector: b. 1744; d. Ratisbon 10 Feb. 1817. Having made his academic studies in the universities of Göttingen and Heidelberg, he devoted himself to the study of canon law and entered the ecclesiastical state. In 1772 he was made, by the Elector-Archbishop of Mayence, privy counselor and governor of Erfurt. His administration was directed purely to the welfare of the people and he earned the reputation of being a faithful and capable man of affairs. He continued in the service of the elector, and at the death of his patron he succeeded him as archbishop, elector, and arch-chancellor of the empire (1802). In 1804 the Pope, Pius VII., being then in Paris for the occasion of the crowning of Napoleon, Archbishop Dalberg was invited by Napoleon to Paris for the purpose of inducing Pope Pius to approve a proposed readjustment of ecclesiastical affairs in Germany. The Archbishop served well the interests of the French emperor, and later had his reward when the readjustment was effected, for, though he had to give up the archiepiscopal see of Mayence and his dignities in the empire, he was more than recompensed by being made metropolitan of Ratisbon, while Aschaffenburg, Wetzlar, and Ratisbon were erected, on his behalf, into a principedom. Further his purely ecclesiastical jurisdiction was enlarged by being made to extend over such parts of the ecclesiastical jurisdiction of Mayence, Cologne, and Treves as lie on the right bank of the Rhine. But of all these dignities and powers, except the archbishopric of Ratisbon, he was deprived after the fall of Napoleon. He was a man of learning, a lover and patron of art, and the intimate friend of Goethe, Schiller, Wieland, and the great contemporary lights of German literature. He was author of several works on philosophy and æsthetics (much consulted by scholars), and he took a lively interest in natural history, mineralogy, chemistry, and agriculture.

**Dalbergia**, a genus of fine tropical forest trees and climbing shrubs, natural order *Leguminosæ*, some species of which yield excellent timber. *D. latifolia* (the blackwood, or East Indian rosewood) is a magnificent tree, furnishing one of the most valuable furniture woods. *D. sissoo* gives a hard durable wood, called sissoo, much employed in India for railroad sleepers, house- and ship-building, etc.

**D'Albert**, *däl-bär*, **Eugene**, English musician: b. Glasgow, Scotland, 10 April 1864. He is the son of an English composer of French descent. He was at first trained by his father, but subsequently studied with Sir Arthur Sullivan and Dr. Stainer, and after 1882 was a pupil of Liszt. He is very famous as a pianist and has given recitals in the chief cities of Europe

and the United States. Besides concertos, string quartettes, songs, etc., he has composed the operas of 'Ruby'; 'Ghismonda'; 'The Departure'; etc.

**Dalby**, **Isaac**, English mathematician: b. Gloucestershire 1744; d. Farnham, Surrey, 3 Feb. 1824. He was self-educated, and while teaching arithmetic in London, his acquirements became known. In 1782 he was appointed mathematical master of the naval school at Chelsea, and in 1787 was employed, on the recommendation of the celebrated instrument-maker Ramsden, to assist Gen. Roy in the great trigonometrical survey. In 1799, on the formation of the Royal Military College at High Wycombe, he was appointed professor of mathematics, and continued to hold the appointment till 1820.

**Dale**, **Alan** (ALFRED J. COHEN), American dramatic critic: b. Birmingham, England, 14 May 1861. After leaving Oxford University he came to the United States and was dramatic critic on the *New York Evening World* 1887-95, and on the *New York Journal* from 1895. He has published: 'Jonathan's Home'; 'A Marriage Below Zero'; 'An Eerie He and She'; 'My Footlight Husband'; 'A Moral Busybody'; etc.

**Dale**, **David**, Scottish manufacturer: b. Stewarton, Ayrshire, 6 Jan. 1739; d. Glasgow 17 March 1806. He commenced life as a weaver, and having made the acquaintance of Sir Richard Arkwright a partnership was entered into between them for the erection of cotton-mills on the Clyde, and the settlement of New Lanark was in consequence formed. He had also extensive shares in other spinning factories established under his superintendence in various parts of Scotland, and was head partner in a large manufacturing firm in Glasgow, besides acting there as agent for the Royal Bank of Scotland. In 1799 he retired from business, and disposed of the works at New Lanark to a company of English capitalists, who entrusted the management of them to the celebrated Robert Owen (q.v.), who afterward married Mr. Dale's eldest daughter. He was the founder and pastor of a small religious sect called "Dalites," or "Old Independents."

**Dale**, **Richard**, American naval officer: b. Norfolk, Va., 6 Nov. 1756; d. Philadelphia 24 Feb. 1826. While serving as a midshipman on board of the American brig of war, Lexington, he was taken by a British cutter; but, after being confined a twelvemonth in prison, he effected his escape into France, where he joined the celebrated Paul Jones, then commanding the American ship *Bon Homme Richard*, and was the first man that boarded the English frigate *Serapis*, which was captured. In 1801 he had the command of an American squadron and hoisted his pennant on board the *President*.

**Dale**, **Robert William**, English Congregational clergyman: b. London 1 Dec. 1829; d. 13 March 1895. He was for many years one of the foremost of non-conformist leaders in England, and in 1877 delivered a series of lectures on preaching at Yale University, being the first Englishman appointed to the Lyman Beecher lectureship. Among his more important writings are: 'The Atonement' (1875); 'Lectures on Preaching' (1877); 'The Epistle to the Ephesians: its Doctrine and Ethics' (1882);

## D'ALEMBERT — DALLAS

'The Living Christ and the Five Gospels' (1890); 'Fellowship of Christ' (1891) He was a versatile and powerful speaker and exercised an extended influence.

**D'Alembert, Jean le Rond.** See ALEMBERT, JEAN LE ROND D'.

**Dalhousie, dāl-hoo'zī or dāl-how'zī, James Andrew Ramsey,** 10TH EARL AND 1ST MARQUIS OF, British statesman: b. near Edinburgh 22 April 1812; d. 19 Dec. 1860. After filling the offices of vice-president (1843) and president of the board of trade (1844), he was appointed governor-general of India (1847). In this post he showed high administrative talent, establishing railway lines, telegraphs, irrigation works, etc., and under his rule was annexed the Punjab, Oude, Berar, and other native states, as well as Pegu in Burma, to the British Empire in India. In 1849 he was made a marquis.

**Dalhousie, New Brunswick,** capital of Restigouche County, and a port of entry. It is situated on Chaleurs Bay and the estuary of Restigouche River. The chief industries are fishing and trading in lumber, salmon, and lobsters. Pop. (1901) 3,000.

**Dalhousie College and University,** an institution of learning located at Halifax, N. S. It was founded in 1818 by the Rt. Hon. George Ramsay (q.v.), 9th earl of Dalhousie, whose last public act in Nova Scotia was the laying of the cornerstone of the old building 22 May 1820, but it was not until 13 Jan. 1821 that the "bill to incorporate the Governors of Dalhousie College at Halifax" became a law. The purpose of the college was originally stated "for the education of youth in the higher branches of science and literature." The first name of Dalhousie was the "College of Halifax," but in 1821 the Legislature granted £1,000 to the new college and named it after its founder. In 1841 university powers were granted to the college. The early history of Dalhousie is a brave struggle for existence. Two attempts were made to unite it with King's College (q.v.) but both proved failures. From 1844 to 1863 Dalhousie ceased to operate as a college and the governors either allowed the funds to accumulate or managed it as a high school. In 1863 the college was reorganized and from this time it may be said to date its modern development as an institution of learning, with a staff of six professors, a tutor in modern languages and about 60 students. The governing powers of the institution are (1) the Board of Governors, the supreme governing body. Appointments to it are made by the Governor-in-Council on the nomination of the Board. The governors have the management of the funds and property of the college; the power of appointing the president, professors, and other officials, and of determining their duties and salaries, and the general oversight of the work of the university. (2) The Senate, consisting of the president and professors. To this body are intrusted, by statute, the internal regulations of the university, subject to the approval of the governors. All degrees are conferred by the Senate. (3) The Faculties of Arts, Science, Law, and Medicine. These are committees of the Senate for the supervision of the teaching of the university, the preparation of regulations governing the courses of study, and the recom-

mendation of suitable candidates for prizes, scholarships, diplomas and degrees.

The college is well equipped for its work and is constantly enlarging its sphere of usefulness. It has a large student body and admits students of either sex. Many generous gifts have been made to Dalhousie, notably those of the late George Munro of New York, in 1879, which did much to put the institution on a solid financial basis. Mr. Alexander McLeod of Halifax, Sir William Young and Mr. John P. Mott have also made large gifts to the college.

**Dalin, dāl'lin, Olof von,** Swedish historian and poet: b. Vinberga, Holland, 29 Aug. 1708; d. Drottingholm 12 Aug. 1763. In 1737 he was appointed royal librarian, and in 1751 became preceptor to the prince royal (afterward Gustavus III.), and in recompense for his zeal and talents was nominated historiographer-royal (1759), and chancellor of the court of Sweden (1763). He exerted much influence by his periodical paper, 'The Swedish Argus' (1733-4), and still more by his spirited poems, particularly 'Satires' (1729), an excellent poem on the liberty of Sweden (1742), many songs, epigrams, and fables. The best edition of his poetical works appeared at Stockholm (1782-3). He acquired equal reputation by his able history of Sweden (1777). He also participated in the foundation of the Academy of Belles-lettres by Ulrica Eleonora, 1753.

**Dall, Caroline Wells Healey,** American author: b. Boston, Mass., 22 June 1822. She has been an industrious literary worker, and is the author of many books, among which are: 'Essays and Sketches' (1849); 'Woman's Right to Labor' (1860); 'The College, the Market, and the Court' (1861); 'Egypt's Place in History' (1868); 'Patty Gray's Journey to the Cotton Islands,' and 'What We Really Know About Shakespeare' (1885).

**Dall, William Healey,** American naturalist: b. Boston, Mass., 21 Aug. 1845. He is the son of Caroline W. H. Dall (q.v.). He is a member of the United States Geological Survey and of many of the scientific societies at home and abroad. Among his published books are: 'Alaska and its Resources' (1870); 'The Currents and Temperatures of Bering Sea and the Adjacent Waters' (1882); and 'Report on the Mollusca, Brachypoda, and Pelecypoda' of the Blake dredging expedition in the West Indies (1886). He has further published: 'Pacific Coast Pilot'; 'Coast Pilot of Alaska,' etc.

**Dallas, Alexander James,** American statesman: b. Island of Jamaica, 21 June 1759; d. Trenton, N. J., 14 Jan. 1817. He studied law in London and settled in Philadelphia in 1783. He became eminent at the bar, and was United States district attorney in Pennsylvania from 1801 to 1814. He was secretary of the treasury under Madison.

**Dallas, George Miffin,** American diplomatist: b. Philadelphia, Pa., 10 July 1792; d. there 31 Dec. 1864. He was the son of A. J. Dallas (q.v.). In 1813 he was admitted to the bar, and soon after entered the diplomatic service. In 1831 he was elected a United States senator from Pennsylvania; was United States minister to Russia 1837-9, and in 1844 was elected Vice-President of the United States. In 1846 his casting-vote as president of the Senate repealed the protective tariff of 1842, though he had

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previously been considered a Protectionist. His course on this question aroused much indignation in Pennsylvania. He was United States minister to Great Britain from 1856 to 1861. His principal published writings were posthumous, and include a 'Series of Letters from London' (1869), and a 'Life of A. J. Dallas' (1871).

**Dallas, Ga.,** town, county-seat of Paulding County; on the Southern Railroad; about 30 miles northwest of Atlanta. Pop. 700.

**Dallas, Ga., Battle Lines at.** After the Confederate evacuation of Dalton (see DALTON, GA., MILITARY OPERATIONS AT), 12 May 1864, and the battle of Resaca, 14-15 May, Gen. Joseph E. Johnston's army retreated by way of Calhoun and Adairsville to Cassville, where Gen. Johnston prepared to make a stand, and Gen. Sherman closed in on him for battle; but Johnston abandoned Cassville during the night of the 19th, and next day crossed to the south side of the Etowah. Sherman occupied Cassville and Kingston, and prepared for another advance. As Johnston held the line of the railroad at Allatoona Pass and other points in advance of Marietta, Sherman concluded to turn those positions by moving from Kingston to Marietta by way of Dallas, a small town about 25 miles south of Kingston and 20 miles west of Marietta, and the converging point of many roads. On the 23d the movement began, but on the same day the Confederate cavalry discovered it, and Johnston divined its intention and prepared to check it by marching to Dallas and covering the roads leading to it.

On the 25th as the advance of Hooker's (Twentieth) corps neared Dallas it was discovered that Hood's Confederate corps held the cross roads at New Hope Church, four miles northeast of Dallas. Hooker concentrated his corps and attacked Hood late in the evening and was repulsed with a loss of 1,346 killed and wounded, and about 60 missing. Hood's loss was less than 400. During the night and early next day the rest of the army moved up on the right and left of Hooker and entrenched, McPherson's two corps, on the right, holding Dallas.

Sherman gradually extended to the left, skirmishing heavily all along the line, and on the evening of the 27th T. J. Wood's division of the Fourth corps attacked the extreme right of the Confederate army near Pickett's Mill and, after a most gallant effort, was repulsed with a loss of 1,224 killed and wounded, and 318 missing. The Confederates reported a loss of 85 killed and 363 wounded. This engagement was a little over two miles northeast of New Hope Church.

There was now heavy skirmishing all along the line, some seven miles in length; and Sherman, still extending to the left, ordered McPherson, who was entrenched at Dallas, to close in on Hooker at New Hope Church, that Hooker might extend to the left; but McPherson deferred the movement until next day (28th), and was getting ready to make it when he was attacked. The Confederates made a desperate effort to seize his works, but were repulsed with a loss of some 390 killed and wounded. McPherson's loss was over 400, of whom 325 were killed and wounded, and 54 missing, in the

Fifteenth corps, which bore the brunt of the assault. This was the battle of Dallas.

Sherman continued his movement to the left; McPherson left Dallas 1 June, and closed in on Hooker at New Hope Church; Hooker went to the left; all the wagon roads leading to Allatoona and Ackworth were secured. Allatoona was seized, also the railroad back to the Etowah, and 4 June Sherman was preparing to attack Johnston at New Hope Church, when he found that he had abandoned all his works and fallen back to Kenesaw Mountain; whereupon Sherman moved to the railroad at Ackworth and Big Shanty, and the first stage of the campaign for Atlanta ended. The Union loss in the battles and constant heavy skirmishing near and at Dallas (25-31 May) was about 3,600 killed and wounded. Johnston reports the Confederate loss at 2,005 killed and wounded. The first stage of the campaign (6-31 May) cost the Union army 9,299 killed, wounded, and missing, Johnston reports the Confederate loss for the same period at 5,807 killed and wounded. Consult: 'Official Records,' Vol. XXXVIII.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.; Cox, 'Atlanta'; Johnston, 'Narrative'; Sherman, 'Memoirs,' Vol. II.; the Century Company's 'Battles and Leaders of the Civil War,' Vol. IV. E. A. CARMAN.

**Dallas, Ore.,** city, county-seat of Polk County; situated on La Creole Creek and the Southern Pacific Railroad; about 70 miles southwest of Portland. The industries are dependent upon the productions of the fertile Willamette valley, in which Dallas is situated. Flour-mills, sash and door factories, saw-mills, woolen factories, and tanneries constitute some of the industries. Sandstone quarries in the vicinity furnish excellent stone. Pop. 2,000.

**Dallas, Texas,** city county-seat of Dallas County; on Trinity River, and on the Missouri, Kansas & Texas, the Texas & New Orleans, the Gulf, Colorado & Santa Fé, the Texas & Pacific, and the Houston & Texas Central R.R.'s; about 200 miles north by west of Austin, the capital of the State. Dallas is in a fertile agricultural region in which the chief products are cotton, wheat, corn, and fruits.

**Manufacturing.**—It has extensive lumber interests and its manufacturing establishments are increasing. The principal manufacturing industry is saddlery in which Dallas leads all other places in the United States; cotton gin machinery is also extensively manufactured; other prominent manufactories are flour-mills, brewery, various iron and metal works, cotton gins, grain elevators, lumber-mills, woolen-mills, cottonseed-oil mills, and cotton compressors.

**Trade and Commerce.**—The wholesale trade of the city embraces all lines of goods, and covers a territory comprising all the States and territories of the southwest, and, in some lines, all of the Southern and Western States. It ranks with Kansas City as first in the distribution of farm machinery and implements. The total wholesale trade in 1903 was \$50,000,000, the largest retail trade in the Southwest. Dallas has an extensive mail order business; the postal and express receipts are twice as large as that of any other city in the State.

**Municipal Service and Improvements.**—The city owns and operates water-works, which cost

## DALLES, THE—DALMATIA

about \$1,500,000. The present supply of water (1903) is secured by impounding storm waters, but it is to be augmented by artesian water. The chief public structures are the county courthouse, Federal building, city hall, and Carnegie Public Library. There are fine office buildings, stores, and hotels.

*Schools, Colleges, and Libraries.*—The public free school system embraces 12 white and five colored schools, at which 8,000 pupils attend, two parish schools and seven suburban schools. Other schools are, Saint Mary's Female College (P. E.), Ursuline Academy, Academy of the Sacred Heart, Saint Mathew's Grammar School, Southwestern University (Med. Dep.), Baylor University (Med. Dep.), Physio-Medical, Dallas Medical, Patton Female Seminary, Landon Conservatory of Music; several business colleges and special and private schools. The Carnegie Public Library cost \$50,000.

*Churches and Charities.*—Dallas is the see of the Roman Catholic and the Protestant Episcopal dioceses, and the official home of a bishop of the Methodist Episcopal Church (South). The number of church edifices are Baptist, 12; Catholic, 7; Christian, 6; Congregational, 4; Episcopal, 6; Evangelical, 3; Methodist, 12; Hebrew, 3; Presbyterian, 10; Christian Science, Seventh Day Adventist, and Unitarian, one each; colored churches of various denominations, 20. The State headquarters of the Salvation Army are located here. The charity institutions are: Buckner's Orphans' Home, Saint Mathew's Home for Aged Women, Women's Home, Parkland Hospital (Pub.), Saint Paul's Sanitarium (R. C.), Cunningham Mission Home, Fowler Orphans' Home, Saint Joseph's Orphanage (R. C.), Dallas Free Kindergarten and Settlement Home, United Charities, and several smaller organizations and institutions.

*Finance and Banking.*—The city has five National banks (one of which is being organized, November 1903), with capital and surplus amounting to \$2,418,000; deposits, \$10,827,324; one private bank; one trust company, capital \$500,000; and 13 savings and loan companies. The National banks are designated as reserve depositories.

*Parks and Cemeteries.*—The parks are well laid out and most attractive. They are the City Park, Oak Lawn, Exall's, Oak Cliff, Spann's, and Zang's. The cemeteries are Greenwood, Oaklawn, Evergreen, Oak Cliff, the Hebrew, the Catholic, the Orthodox Jews', Odd Fellows', Masons', and two for the colored people.

*Government.*—The government is vested in a mayor and 12 aldermen, chosen biennially by the people, and a police commissioner and a fire commissioner, appointed biennially by the governor of Texas.

*Growth and Population.*—Since 1900, the last Federal Census, the area of the city has been extended from seven and one half to nine square miles. Pop. (1890) 38,067; (1900) 42,638; including recent addition, the population in 1900 was 46,268. Pop. 1903, est. 65,000. (The Dallas city directory estimates the population as 75,415.)

THOMAS FINTY, JR.,  
(Dallas Morning News.)

Dalles, The, or Dalles City, Ore., county seat of Wasco County; on the Oregon Railroad. It is about 30 miles northeast of Mount Hood, and on that portion of the Columbia River (on the Washington State boundary line) where the scenery is noted for grandeur. It is situated in a sheep and cattle-raising country, hence its trade is largely in cattle and wool. Fruits grow here in the Columbia Valley. Its chief industries are flour and grist milling, and wool scouring. A military post at Fort Dalles was established in 1838, and about the same time a mission was opened by the Methodist Church. The railroad station is known by the name of Dalles, and the local name often used is Dalles City; but the name of the post-office is The Dalles. Pop. (1900) 3,542.

**Dallin, Cyrus Edwin**, American sculptor: b. Springville, Utah, 22 Nov. 1861. He studied at the Ecole des Beaux Arts, and the Julian Academy, Paris, and has since practised his art in Boston, where he is instructor in sculpture in the Massachusetts State Normal Art School. He is a member of various art societies and among medals received by him are the gold medal of the American Arts Association in 1888, and the first-class medal of the World's Columbian Exposition at Chicago, 1893. Among his most important works are the 'Pioneer Monument,' and the 'Angel' for the Temple, both at Salt Lake City; 'Sir Isaac Newton' in the Congressional Library; the 'Medicine Man,' Fairmount Park, Philadelphia; 'The Signal of Peace,' Lincoln Park, Chicago.

**Dallinger, Frederick William**, American lawyer: b. Cambridge, Mass., 2 Oct. 1871. He was graduated from Harvard 1893, and the Harvard Law School in 1897, and was admitted to the Suffolk bar in 1897. He was a member of the lower House of the State legislature in 1894, and of the State Senate 1896-9. He has published: 'Voters' Pocket Manual' (with Pryor) (1892); 'Manual of Civil Government for Use in Public Schools' (1893); 'Nominations for Elective Office in the United States' (1896).

**Dallinger, William Henry**, English scientist and clergyman: b. Devonport, England, 5 July 1842. He entered the Wesleyan ministry in 1861 and after being minister at Liverpool 12 years was governor of Wesley College, Sheffield, 1880-8. His microscopical researches began in 1870. He became Fellow of the Royal Society in 1880, has been Rede lecturer to the University of Cambridge, lecturer at Oxford and at the Royal Institution, and was president of the Royal Microscopical Society 1883-7. He has published 'Minute Forms of Life' (1886); 'The Origin of Life' (1878); 'The Creator and What we may Know of the Method of Creation' (1887); revision of Carpenter's 'The Microscope and its Revelations' (1891).

**Dalma'tia**, a province of Austria, and the most southern crownland of the Austrian dominions. It consists of a long, narrow, triangular tract of mountainous country, and a number of large islands, along the northeast coast of the Adriatic Sea. In breadth it is very limited, not exceeding 40 miles in any part. The surface is much varied: a ridge of limestone mountains separates the north portion from

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Bosnia, and another runs nearly parallel with the coast, sterile, and destitute of soil. The highest peak is Orien, 6,225 feet. The waters of many of the Dalmatian streams have a petrifying quality, and cover the rocks over which they flow with a coarse stalagmitic deposit. The country is not rich in metals, although in ancient times it is said to have produced gold. In mineral wealth Dalmatia is the poorest of the Austrian provinces, but some brown coal and asphalt are obtained, also manganese ore and salt. Most of the islands are mountainous, and present the same general aspect as continental Dalmatia, but are valuable for their productions, such as timber, wine, oil, cheese, honey, salt, and asphalt; and in several of them ship-building is carried on to a considerable extent. In summer the prevalent wind on the coast is the mistral, or northwest wind, which moderates the excessive heat of the season. The climate of Dalmatia, generally, is warmer than in any other part of the Austrian dominions.

Agriculture is in an extremely backward state, but it is said to have shown considerable improvement of late. The principal agricultural productions are maize, rye, barley, figs, olives, and vines; but sufficient grain is not produced to supply the wants of the country. Dalmatia has hardly any manufactures worthy of the name. A kind of coarse cloth used by the peasants is made. The production of silk has been introduced, and the soil is well suited to the growth of the mulberry-tree. There is a considerable manufacture of liqueurs at Zara, the principal of which is the far-famed maraschino.

The Dalmatians of the coast, and the principal families in the large towns of the interior, are mostly of Venetian extraction; and those who are of Hungarian origin have adopted the customs and language of the Italians. The latter is spoken in all the seaports; but the language of the country is a dialect of the Slavonic, which alone is used by the peasants in the interior. The Dalmatians are a tall, muscular, and vigorous race, generally hospitable, but lazy, vindictive, and dissipated.

The majority of the inhabitants are Roman Catholics, but there are also a considerable number of Greek Catholics. Education is generally diffused by the system of national schools, but it is of a very elementary character. Principal towns — Zara the capital, Spalatro, and Ragusa. Dalmatia was conquered by the Romans in the time of Augustus. In the 7th century it was taken by the Slavs, who founded there a kingdom that lasted till 1050, when the greater part of it was united to Hungary, and the remainder passed under the protection of Venice. In 1797 the Venetian portion, along with the city of Venice, was ceded to Austria; but in 1805, by the treaty of Pressburg, it fell into the hands of Napoleon, who first united it to the kingdom of Italy, and subsequently in 1810, to the kingdom of Illyria. The events of 1814 brought Dalmatia again under Austrian rule. A partial insurrection broke out against the government in October 1869, but was suppressed in the February of the following year. Dalmatia has a diet of its own of 43 members; and it sends 11 deputies to the Austrian House of Representatives. Pop. 593,784.

**Dalmatian Dog.** See COACH-DOG.

**Dalmat'ic** (*Dalmatica*), an ecclesiastical vestment, open at each side below the insertion of the

sleeves, which are wide. It is the principal vestment worn by the deacon in the Roman Catholic Church when ministering at the Mass, or in processions and in other functions. It is also worn under the chasuble, by bishops, when they celebrate the Mass pontifically; and it is a part of the vesture of a king both in England and in continental European countries. It is commonly of silk; its color varies according to directions of the ritual. The dalmatic was originally a long under-garment of white Dalmatian wool, but little different from the Roman tunic, and not till the fourth century was it a distinctively ecclesiastical garment. At first it was worn only by the Roman deacons, but later its use extended throughout the whole Church. So, too, the use of the dalmatic as part of the solemn attire of bishops was at first restricted to the Pope, but afterward was conceded to all bishops. In the Greek Church a vestment answering to the dalmatic, called stoicharion, is worn by deacons in solemn functions, and in the same Church the celebrating priest wears the stoicharion under the chasuble; but in this case the garment is always white. The two stripes, usually on the dalmatic, were originally purple, that is, a shade near scarlet, and were probably a survival of the *latus clavus* of the tunic of senators.

**Dalny**, däl'y-nī, Russia, city and free port 20 miles north of Port Arthur; at the east terminus of the Siberian Railway; connected with Saint Petersburg by the Central Manchurian Railway. It was established expressly for a commercial seaport by an edict of the czar of Russia, dated 30 July 1899. It was thrown open to the commerce of all nations 1 Dec. 1901. Dalny is situated on the Liao-tung Peninsula, which extends south into the Gulf of Pechili, China.

The harbor, in which vessels drawing 30 feet can enter at low water, is one of the finest and deepest on the Pacific. The surface of the bay is sufficient for all the shipping of China. Great piers are being built of blocks of stone and cement which weigh from 20 to 50 tons each. Seven railroad tracks and nine large warehouses are being constructed on the piers. A large break-water is being made across the pier harbors, which will allow ships to lie at the piers, and regardless of weather to load or unload.

The port will have no custom-house, but will be absolutely free, not even the small rates of Chinese customs being charged on goods being imported or exported. For the encouragement and development of commerce only the lowest possible rates will be required for tonnage, and the use of docks, wharves, and warehouses. The policy of low charges, the easy access to the harbor during all seasons of the year, the small labor needed to transfer goods from the ocean steamers to the cars, and the cheap coolie service will combine to make this the most economical shipping port in the Occident. The rules governing the city were approved by the emperor of Russia 16 Aug. 1899. The Chinese Railway Company is to build the city under the direction of the Russian minister of finance. Pop. (1903) 41,260.

**Dalrymple**, däl-rīm'pl, **Alexander**, Scottish hydrographer: b. Hailes, near Edinburgh, 24 July 1737; d. London 19 June 1808. In 1752 he went to India in the service of the East India Company, and while there made hydrography his



## DALRYMPLE — DALTON

particular study. In 1795 he obtained the appointment of hydrographer to the Admiralty, as well as to the East India Company. His most important publications are: 'Discoveries in the South Pacific Ocean'; 'A Collection of South Sea Voyages'; 'A Relation of Expeditions from Fort Marlborough to the Islands of the West Coast of Sumatra'; 'A Collection of Voyages in the South Atlantic Ocean'; 'A Memoir of a Map of the Land Round the North Pole'; 'Journal of the Expeditions to the North of California'; 'The Oriental Repertory.' He was also the author of many historical and political tracts.

**Dalrymple, Sir David, Lord Hailes**, Scottish lawyer and antiquary: b. Edinburgh 27 Oct. 1726; d. 29 Nov. 1792. In 1766 he was made lord of session with the title of Lord Hailes, and later a lord of judiciary. He published 'Annals of Scotland' (1786), and other works on Scottish history, both ecclesiastical and political, antiquities, etc.

**Dalrymple, James, 1st Viscount Stair**, Scottish lawyer and statesman, b. Carrick, Ayrshire, May, 1619; d. Edinburgh 25 Nov. 1695. In the civil war he sided with Parliament, but soon relinquished that party, and became professor of philosophy at Glasgow. He then adopted law as a profession, and in 1670 was made president of the Court of Sessions. He was adverse to the severe measures adopted against the Covenanters, and having excited the enmity of the Duke of York, lost his appointments, and retired to Holland in 1682. Here he became a favorite with the Prince of Orange, who, after the revolution, created him Viscount Stair. Stair wrote: 'The Institutes of the Laws of Scotland' (still a standard authority); 'Philosophia nova experimentalis'; 'Vindication of the Divine Perfections'; 'An Apology for his Own Conduct'; etc.

**Dalrymple, John, 1st Earl of Stair**, Scottish statesman: b. 1648; d. 8 Jan. 1707. He was son of James Dalrymple (q.v.). He was called to the Scottish bar in 1672, and his eloquence and ability soon gained him a leading place in his profession, as later in the Scottish Parliament. Under Charles II. he suffered imprisonment twice for not sufficiently enforcing the persecuting acts, but held office in Scotland under James. He was largely instrumental in carrying out the 1688 revolution in Scotland, and for some time acted as the king's representative in that country, but his undoubted services have been somewhat discounted by his connection with the massacre of Glencoe in 1692. He assisted largely in bringing about the union between England and Scotland. He succeeded his father as viscount in 1695, and in 1703 was created earl.

**Dalrymple, John, 2d Earl of Stair**, Scottish general; b. Edinburgh 20 July 1673; d. there 9 May 1747. He entered the Cameronian Regiment in 1692, and in 1701 was appointed lieutenant-colonel of the Scots regiment of foot guards. In 1707 he succeeded to the earldom and became one of the Scottish representative peers, but still continued his military life, and distinguished himself in the campaigns of Marlborough, and more particularly at the battles of Oudenarde, Malplaquet, and Ramillies. On the accession of George I. he was appointed a privy counselor, and went on a diplomatic mission to France, where he attracted much notice by the splendor

of his retinue, and also displayed great skill and address. He returned in 1720, and for the next 20 years he took an active interest in agricultural pursuits. In 1742, on the dissolution of Walpole's administration, he again entered public life, and continued to act in different capacities, civil and military, till his death.

**Dalsgaard, Christen**, krist'en däl'sgärd, Danish artist: b. Krabbesholm, Jutland, 30 Oct. 1824. He studied at the Copenhagen Academy. Among his paintings, which deal mostly with Danish peasant life, are: 'Christmas Morning'; 'Jutland Peasants going to Communion'; 'Fisherman and Daughter'; 'Seizure for Debt'; 'One of the Wise Virgins'; 'Ansgar and Odbert Baptizing Mother and Child.'

**Dalton, John**, English chemist and physicist: b. Eaglesfield, near Cockermouth, Cumberland, 6 Sept. 1766; d. Manchester 27 July 1844. He was mainly self-educated, and showed such a decided turn for mathematics that he obtained the position of professor of mathematics and natural philosophy in New College, Mosley Street, Manchester, in 1793. The same year he published his early meteorological observations and essays. In 1799, on the removal of New College to York, he resigned his chair, but continued to give private lessons in the same branches. In 1808 he commenced the publication of his 'New System of Chemical Philosophy,' which, containing his brilliant discovery of the atomic theory, produced an important revolution in the science, gave him a very high place among philosophical chemists, and spread his fame over Europe. The Royal Society of London in 1826 admitted him a member, and unanimously awarded to him the first of two gold medals intended for those who had made the greatest discoveries in science. He was also elected member of the Institute of France, of the Royal Academies of Science of Berlin and Munich, and of the Natural History Society of Moscow. See 'Life,' by Lonsdale (1874); Roscoe and Harden, 'New View of the Origin of Dalton's Atomic Theory' (1896).

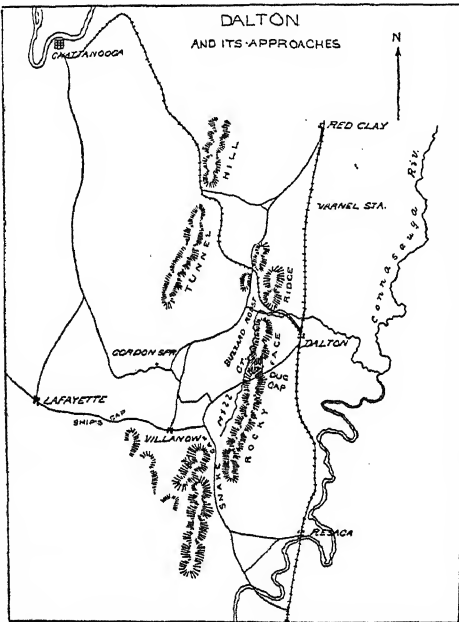
**Dalton, John Call**, American physiologist: b. Chelmsford, Mass., 2 Feb. 1825; d. New York 11 Feb. 1889. He was graduated at Harvard in 1844 and at Harvard Medical School in 1847. He was successively professor of physiology at the University of Buffalo, at the Vermont Medical School, at the Long Island College Hospital, and at the New York College of Physicians and Surgeons. He served as an army surgeon throughout the Civil War. His published works include: 'Human Physiology' (1859); 'Physiology and Hygiene for Schools, Families and Colleges' (1868); 'The Experimental Method of Medicine' (1882); 'Topographical Anatomy of the Brain' (1885).

**Dalton, Ga.**, city and county-seat of Whitfield County; on the Southern and the Nashville, Chattanooga & Saint Louis railroads; 100 miles northwest of Atlanta. It is a health resort, and the seat of Dalton Female College. It has canning factories, cotton compresses, flour-mills, foundries and machine shops, public schools, weekly newspapers, and a national bank. Pop. 4,315.

**Dalton, Ga., Military Operations** at (23-25 Feb. 1864, and 8-12 May 1864, including engagements at Buzzard's Roost Gap, Dug Gap,

## DALTON-IN-FURNESS — DALTONISM

Rocky Face Ridge, and Varnell Station). Dalton is in the northwestern part of Georgia, where the Chattanooga and Atlanta R.R. is intersected by that from Cleveland, Tenn. By rail it is 38 miles southeast of Chattanooga. When Gen. Bragg was supposed definitely to have abandoned Chattanooga, 9 Sept. 1863, Gen. Halleck ordered Gen. Rosecrans to occupy Dalton, and there Bragg retreated after his defeat at Lookout Mountain and Missionary Ridge, 24-25 Nov. 1863. In February 1864 Gen. Grant ordered Gen. Thomas to seize the town. Thomas moved, reported that he could not carry the position, and the effort was abandoned. His movement cost the Union army about 300 killed and wounded, and the Confederates about 200.



Dalton, the first objective point of Sherman's Atlanta campaign, was held 30 April 1864, by Gen. J. E. Johnston, with 54,400 men. The approaches to the place were difficult, and it was practically impregnable. Early in May Sherman concentrated his grand army in and around Chattanooga for his Atlanta campaign. It was made up of the armies of the Cumberland, Tennessee, and Ohio, commanded respectively by Gens. Geo. H. Thomas, J. B. McPherson, and J. M. Schofield, aggregating 98,797 men and 254 guns. The Army of the Cumberland had about 60,000 men, the Army of the Tennessee 25,000, and the Army of the Ohio, 14,000. On 6 May the Army of the Cumberland was at and near Ringgold, the army of the Tennessee at Gordon's Mill, on the Chickamauga, and the Army of the Ohio near Red Clay, on the Georgia line, north of Dalton. The four corps of Thomas and Schofield were ordered to move on Dalton in front, while McPherson with two corps moved through Snake Creek Gap. On the 7th McPherson was ordered to march from Gordon's Mills through the Gap to Resaca, 18 miles south of Dalton. He marched by way of Ship's Gap and Villanow, pushed through Snake Creek Gap, a wild defile, nearly six miles

long, 15 miles south of Buzzard's Roost, and on the morning of the 9th drove back Grigsby's Kentucky cavalry brigade, and marched to within a mile of Resaca, then held by two brigades under Gen. Cantey. Finding the place too strong to be assaulted, McPherson fell back to a strong position at the east end of the Gap. Meanwhile Thomas and Schofield had pressed forward. Thomas drove the Confederates in his front full through Buzzard's Roost Gap, and Schofield closed down on Thomas' left. On the 8th there was heavy skirmishing between Thomas and the Confederate divisions of Stewart and Bate at Buzzard's Roost, and about six miles farther south a determined assault.

The road from Lafayette to Dalton passes through a cleft in the palisade, which had been deepened and widened, hence known as Dug Gap. Geary's division attacked this gap. Skirmishers were thrown out who drove those of the enemy from the foot of the ridge and up the road nearly to the summit, when two brigades were formed in double lines on either side of the road. The Confederates were driven clear to the summit. The position of the Gap could not be carried, and an assault on the perpendicular palisade south of it was ordered, where it was broken by a few clefts through which four or five men could move abreast. The men charged, a few reached the summit, to be killed or captured, and the assault failed. After a short breathing-spell another effort was repulsed with much loss. Still another attempt was made by a single regiment, but it also failed. Everywhere the assault was repulsed, and the Federals withdrew after a loss of 306 killed and wounded, and 51 captured or missing. It is doubtful if the Confederate loss exceeded 30 men. At Varnell's Station Stoneman's and Wheeler's cavalry divisions had an engagement in which the loss was about 150 on each side, and Thomas pressed so vigorously in front of Buzzard's Roost that the heavy skirmishing attained the dimensions of a battle. By the 11th Sherman moved his army to pass through Snake Creek Gap. On the evening of the 12th Johnston was fully informed of the movement toward his rear, which had been covered by the ridge and the forests of the country, and he abandoned his position that night to give Sherman battle at Resaca. On the morning of the 13th Howard occupied Dalton. The Union loss around Dalton, 7-12 May, was about 830 killed and wounded; the Confederate loss not more than half that number. Consult: 'Official Records,' Vol. XXXVIII.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.; Johnston, 'Narrative,' Sherman, 'Memoirs,' Vol. II.; Cox, 'Atlanta'; the Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

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**Dalton-in-Furness**, England, town in Lancashire, and 30 miles northwest of Lancaster by the Furness Railway. In its vicinity are extensive iron works, rich hematite iron-ore mines, and the ruins of the magnificent abbey of Furness. Dalton Castle, an old tower in the town, was formerly associated with Furness Abbey. The painter Romney was born and buried here. It is connected with the Irish Sea by a canal three miles long. Pop. (1901) 13,020.

**Daltonism**. See COLOR BLINDNESS.

## DALTON'S LAW — DAMAGES

**Dalton's Law.** See PNEUMATICS.

**D'Alviella, dāl-vē-ēl-lā, COUNT Goblet,** gōb-lā, Belgian savant: b. Brussels 10 Aug. 1846. He was educated at Brussels and Paris and in 1879 married a Miss Packard of Albany, N. Y. He is a member of the Royal Academy of Belgium and of the Royal Asiatic Society of Great Britain. He was for some time director of the 'Revue de Belgique,' was Hibbert lecturer at Oxford University in 1891, and has published 'Sahara and Lapland' (1874); 'Inde et Himalaya' (1877); 'Contemporary Evolution of Religious Thought in England, America and India' (1885); Hibbert Lectures on 'Origin and Growth of the Conception of God' (1892); 'The Migration of Symbols' (1894); 'Ce que l'Inde doit à la Grèce' (1897); and other works in French.

**Daly, Charles Patrick,** American jurist and author: b. New York, 31 Oct. 1816; d. 19 Sept. 1899. He had a distinguished judicial career in his native city, becoming justice of the court of common pleas in 1844, first judge of the court in 1857, and chief justice in 1871, retiring on account of age in 1886. He was president of the American Geographical Society for many years prior to his death. His works include: 'First Settlement of Jews in North America'; 'What We Know of Maps and Map Drawing Before Mercator,' and similar investigations.

**Daly, John Augustin,** American dramatist and theatrical proprietor: b. Plymouth, N. C., 20 July 1838; d. Paris 7 June 1899. In 1869 he opened his Fifth Avenue Theatre in 24th Street, New York; and after its destruction by fire in 1873 he opened its successor in 28th Street. In 1879 he opened Daly's Theatre in Broadway. Among his original plays are 'Divorce'; 'Pique'; 'Horizon'; 'Under the Gaslight.' He also wrote: 'Peg Woffington, a Tribute to the Actress and the Woman.'

**Daly, Joseph Francis,** American lawyer: b. Plymouth, N. C., 3 Dec. 1840. He was educated in New York, studied law and was admitted to the bar there in 1862. He was judge of the court of common pleas, 1870-96, and chief justice of the same 1890-6. He was also justice of the Supreme Court 1896-8. He was one of the founders of the Players' Club in New York and was president of the Catholic Club 1894-9.

**Dalyell, or Dalzell, Thomas,** Scottish soldier: b. about 1599; d. 23 Aug. 1685. He was taken prisoner fighting on the royalist side at Worcester, and afterward escaped to Russia, where he was made a general. Returning to England at the Restoration, he was made commander-in-chief of the forces in Scotland, and made himself notorious for his ferocity against the Covenanters.

**Dalzell, John,** American lawyer: b. New York 19 April 1845. He removed with his parents to Pittsburg in 1847, was educated at Yale and after studying law was admitted to the bar in 1867. He has practised his profession in Pittsburg and has been an attorney for the Pennsylvania Railroad Company for its western lines for many years. He has been a Republican member of Congress from 1887 and served on the Ways and Means Committee in the Fifty-fourth and succeeding Congresses.

**Dalziel, Edward,** English painter and illustrator: b. Wooler, England, 5 Dec. 1817. He went to London in 1839 and became associated with his brother George in painting, drawing, and wood engraving, the firm of the Brothers Dalziel having been for half a century well known in relation to illustration of a high character. He has exhibited at the Royal Academy and Royal Institute of Painters in Oil, and with his brother wrote: 'The Brothers Dalziel: a Record of Fifty Years, 1840-1890.'

**Dalziel, George,** English wood engraver: b. Northumberland 1816; d. Hampstead 7 Aug. 1902. He was a brother of Thomas Dalziel (q.v.) He established himself in London where he was joined by his two brothers, and the firm soon became famous for the excellence of its illustrated works, the best artists in England being engaged to draw blocks for their use.

**Dama, dā'mā,** a genus of the deer family (*Cervidae*), comprising the common fallow deer (*Dama vulgaris*) and the Persian fallow deer (*D. mesopotamica*). The name is also given to a species of large gazelle (*Gazella dama*) found in the Sudan. It is allied to the mohr (q.v.), but with relatively shorter lyrate horns and no dark stripe on the flanks. Closely allied to it also is the aoul (q.v.) of Somaliland.

**Dam'ages,** the indemnity recoverable by a person who has sustained an injury, either in his person, property, or relative rights, through the act or default of another; also, the sum claimed as such indemnity by a plaintiff in his complaint. Compensatory damages are damages allowed as a recompense for the injury actually received. Consequential damages are those which though directly, are not immediately consequential upon the act or default complained of. Exemplary, vindictive or punitive damages are, in legal contemplation, synonymous terms. Exemplary damages would seem to mean such damages as would be a good round compensation, and an adequate remedy for the injury sustained, and such as might serve for a wholesome example to others in like cases.

Where injuries are maliciously, wantonly, or recklessly inflicted, the right of the jury to award punitive damages is said to be as old as the right of trial by jury itself, and is not, as some seem to suppose, an innovation upon the rules of the common law. In England as early as 1763, it was declared that the jury had done right in giving punitive damages. (*Hackle v. Money*, 2 Wils. 205). And now, both in England and in the United States, the doctrine of punitive damages seems to be well settled, and the right of the jury to give such damages in a proper case cannot be shaken in any of the States by anything short of legislative enactments.

General damages are those which necessarily and by implication of law result from the default or act complained of. Special damages are such as arise directly, but not necessarily, from the wrongful act or default complained of. Parties entering into an agreement may estimate beforehand the amount of damages to result from a breach of the agreement, and may prescribe in the agreement itself the sum to be paid by either of the parties to the other by way of damages for such breach. Such damages are called liquidated damages, when sanctioned by the law. If, however, the agreement is such that the law



## DAMAN — DAMASCUS

refuses to adopt it, then the damages agreed upon will be regarded as a penalty, or as in the nature of a penalty. General damages need not be alleged in the complaint of the person injured, nor is it necessary that any specific proof of damages be given to entitle the party injured to recover. The legal presumption of injury in cases where it arises is sufficient to maintain the action. Whether special damage be the gist of the action, or only collateral to it, it must be particularly stated in the complaint, as the plaintiff will not be permitted otherwise to go into evidence of it at the trial, because the defendant cannot also be prepared to answer it.

To constitute a right to recover damages, the party claiming damages must have sustained a loss; the party against whom they are claimed must be chargeable with a wrong; the loss must be the natural and proximate cause of the wrong. Where there is no loss there is no right to damages, properly so called. A sum in which the wrong-doer is mulcted simply as a punishment for his wrong, and irrespective of any loss caused thereby, is a "fine" or a "penalty," rather than damages. Damages are based on the idea of a loss to be compensated, a damage to be made good. It is not necessary, however, that this loss should always be distinct and definite, capable of exact description, or of measurement in money. A sufficient loss may appear, from the case itself, to sustain an action. A sufficient loss to sustain an action may appear from the mere nature of the case itself. The law in many cases presumes a loss where a wilful wrong is proved; and thus damages are also awarded for injured feelings, bodily pain, grief of mind, injury to reputation, and for other sufferings which cannot be made the subjects of exact proof and computation in respect to the amount of loss sustained.

**Daman**, *dā-mān'*, or **Damão**, India, a sea-port town in Hindustan, at the mouth of the Gulf of Cambay, on the Damanganga or river of Daman, 100 miles north from Bombay. It belongs to the Portuguese, who sacked it in 1531, retook it in 1558, and have kept possession of it ever since. It carries on some cotton-weaving, fishing, ship-building and several salt works. Pop. about 6,000. The Portuguese district here of the same name possesses valuable teak forests. It has an area of 148 square miles. Pop. about 64,000.

**Daman**, *dā-man*, the Syrian name for the coney of Scripture. See **CONY**; **HYRAX**.

**Damanhur**, *dā-mān-hoor'*, Egypt, town of Lower Egypt, capital of the province of Beharah, an important railway centre and seat of cotton manufacture. Pop. (1897) 27,236.

**Damaraland**, *dā-mā'rā-länd*, a district of German Southwest Africa, bounded on the west by the Atlantic Ocean. It is mountainous, some of the peaks ranging in height from low hills to elevations of over 8,000 feet. In some parts there are broad prairies, which could afford pasturage for thousands of cattle. In the mountains have been found rich deposits of copper. The produce of the interior consists of ivory, feathers, skins, etc. The Damaras, properly Herero, a Bantu stem, number about 80,000, of whom 50,000 live in the mountain district; they are nomads, and own large flocks and herds. The Hawkoim, or Hill Damaras, in the northeast, however, who are a much lower type, now speak Hottentot.

The only harbor in this part of the coast is Wal-fisch Bay, which properly belongs to Nama Land; it was annexed to Cape Colony in 1884. In the same year the desert region along the coast was made a German protectorate.

**Damascene**, *dām'a-sēn*, **St. John** (**JOANNES DAMASCENUS**, **JOHN OF DAMASCUS**), a monk and an illustrious theologian of the Greek Church in the 8th century, native of Damascus, b. about 700; d. about 755. He was the first to reduce to system the Church's dogmas and to classify the decrees of the General Councils concerning matters of faith; this he does in the third part of his work: 'The Fountain of Knowledge.' In the first part: 'Points of Philosophy,' he makes application to theology of the principles of Aristotle's *Dialectica*; the second part consists of a reproduction of Epiphanius' work: 'On Heresies,' with additional notices of heresies condemned by the Church after Epiphanius' time; the third and most valuable part is the 'Precise Exposition of the Orthodox Belief.' In mediæval times the 'Precise Exposition,' translated into Latin in the 12th century, gave direction to the theological views and speculations of the schoolmen; and hence Damascenus has been denominated the "Father of Scholasticism." Many other treatises are extant which bear his name as author, but of most of these the authenticity is doubtful. No contemporary account of his life has come down to us; the earliest biographical notice of him that we have dates from the 10th century, and that is unworthy of credit. The epithet: "Chrysorrhoas," that is, gold-streaming, bestowed upon him in his lifetime, testifies to his reputation for eloquence. He is recognized as a saint both in the Greek and the Latin Church.

**Damascus**, *da-māsh'ī-ūs*, a philosopher, so called from his supposed native place Damascus, lived in the beginning of the 6th century. He is known as one of the most distinguished teachers of the Neoplatonic philosophy. In Alexandria he studied rhetoric under Theon and mathematics under Ammonius; and afterward in Athens his teachers were Zenodotus and Marinus, the successors of the more celebrated Proclus. Numerous fragments of his writings remain, one of which is entitled: 'Doubts and Solutions respecting the First Principles.' It is so mystical as to be almost unintelligible, but it is important to the history of philosophy from its frequent notices of earlier philosophers.

**Damas'cus** (native name **DIMISHK-ES-SHĀM**, Syria), a celebrated city, capital of the Turkish vilayet of Syria, finely situated on a plain, at the eastern base of the Anti-Libanus range, supposed to be the most ancient city in the world. It is six miles in circumference, and is surrounded by a dilapidated wall. The plain on which the city stands is of great extent, and is covered with the most beautiful gardens and orchards, irrigated by the waters of the Barrada, forming a grove of more than 50 miles in circuit, rich in fruits, including oranges, lemons, citrons, pomegranates, mulberries, figs, plums, walnuts, pears, and apples. The interior of Damascus by no means corresponds with the beauty of its environs. The streets are narrow and crooked, paved with basalt, and have a gloomy and dilapidated appearance; they are generally in three divisions —

## DAMASCUS BLADES

that in the middle devoted to cattle and riders being the lowest, and of the same width as the other two. In most parts of the city the fronts of the houses are built with mud, and pierced by a very few small grated windows, with red painted shutters. They are low, with flat-arched doors, resembling those of stables, while a dung-hill and pool of putrid water almost invariably stand before each door. In many of them, however, a singular contrast is presented between the dull, prison-like outer walls of gray mud and the richness within. Interiorly they are of a quadrangular form, enclosing a court paved with marble, ornamented with beautiful trees and flowering bushes, and having copious fountains playing in the centre. The lower rooms on each side of the court are raised above its area, and open in front—their roofs and walls highly ornamented with figures of flowers and inscriptions, and a variety of arabesque devices. The furniture, also, is of the most splendid description. The best and wealthiest part of the city is the Moslem quarter, where the streets are wider and cleaner, the houses higher and better built, and the supply of water much more abundant than in any other part of the town. The Christian and Jewish quarters are the most miserable.

Among the places most worthy of notice in Damascus are the bazaars. They are merely long streets—the principal one about one and a half miles in length—covered in with high wood-work, and lined with shops, stalls, stores, and cafés. The shops are narrow, and go only a short way back. There is a separate bazaar for almost every commodity exposed to sale, and all of them are patrolled by multitudes of confectioners and dealers in ices and cooled sherbets. In the midst of the bazaars stands the Great Khan, said to be one of the most magnificent structures of its kind. It is an immense cupola, supported on granite pillars, and built, in part, of alternate layers of black and white marble. Its gate is one of the finest specimens of Moorish architecture to be seen in the world. In this building, and in 30 inferior khans, purchases and sales are daily conducted by the merchants, who have their counting-houses near them. The principal mosque, a fine edifice, was destroyed by fire 14 Oct. 1893. There are three Latin monasteries in Damascus—those of the Franciscans, Capuchins, and Lazarists. The principal Roman Catholic churches form part of the monastic buildings; there are, besides, a number of detached churches belonging to different sects in various parts of the city. Besides the more remarkable architectural objects mentioned, there are an extensive citadel, and a serai or palace, in which the pasha resides. The most interesting locality in the city is, perhaps, what is called "Straight Street," mentioned in connection with the conversion of the apostle Paul. It is the most important, largest and busiest street in Damascus; is about one mile in length, and runs from east to west. The house of Judas, also, to which Ananias went, is still pointed out, as well as that of Ananias.

Damascus was formerly a great emporium of trade between Europe and the East, and still imports English cottons and other goods to the yearly value of about \$2,590,000. It is also a place of considerable manufacturing industry. There are a number of manufactories of silk, damasks, cotton, and other fabrics; numerous

cotton-printing and dyeing establishments, tobacco factories, copper and iron foundries, and glass works. The manufacture of Damascus blades, for which the city was once so celebrated, no longer exists. Saddles and bridles, rich and highly finished, fine cabinet work, and elegant jewelry, are among the manufactures of Damascus. It is one of the holy cities, and here the pilgrims assemble on their journey to, and separate on their return from Mecca. Until a very recent period no Christian could walk the streets without incurring the risk of being insulted, and probably maltreated, by its fanatical population; and no farther back than the year 1860 a considerable number of Christians were massacred by the bigoted Moslems. This intense hatred of the Frank, however, is now considerably abated.

Damascus to-day is perhaps the most thoroughly Oriental in all its features and characteristics of any city in existence. Of its origin nothing certain is known. There is, however, abundant evidence of its great antiquity, as it is mentioned in Gen. xiv. 15, as existing 1913 B.C., and appears even then to have been a place of note. At subsequent periods it fell successively under the power of the Israelites under David, the Persians, Greeks, and Romans, attaining great eminence under the last. In 1516 it fell into the hands of the Turks. A Protestant mission and schools have long been in operation here. Beirut is the seaport of Damascus, and is reached by a road 70 miles long. A railroad has been constructed from Beirut, and one from Damascus to the Hauran. Gas and street cars have recently been introduced. Pop. (estimated for 1898) 225,000, of whom perhaps 25,000 are Christians.

**Damascus Blades**, swords or scimitars formerly made chiefly at Damascus. These famous weapons, though in use among nations little skilled in the metallurgic arts, long before the Christian era, and made familiar to the European nations from the time of the crusades, long defied all attempts at imitation. It appears that the Indian wootz was in ancient times carried from the region of Golconda in Hindustan (where, as well as in Persia, it still continues to be manufactured by the original rude process), and at Damascus was converted into weapons. These were particularly distinguished for their keen edge, capable of severing heavy iron spears or cutting the most delicate gossamer fabric floating in the air; and for the peculiar watered appearance of the steel, which was covered with delicate black, white, and silvery veins, parallel to each other or interlaced. The Damascus appearance may be given to iron by welding together bars of different degrees of hardness, drawing them down, and repeating the process several times. (See DAMASCUS IRON.) Karsten suggests that by the use of bars of good steel the best Oriental blades may have been fashioned in this way. The "mosaic" process differed from the other by cutting the bar into short lengths and fagoting these pieces, the cut surfaces always being placed so as to face outward. Blades of great excellence were thus produced, but still inferior to the genuine Damascus. It was not till after the investigations of Gen. Anossoff in the first half of the 19th century that successful reproductions were obtained. These researches led to the

## DAMASCUS IRON—DAMASK MANUFACTURE

establishment of works at Zlatoosk in the Ural Mountains, where Anosoff manufactured Damascus steel by processes of his own invention. According to his best method 11 pounds of iron were melted in the crucible with one twelfth as much graphite and one thirty-second part of scales of iron. All his sword blades were tempered in boiling grease. The process of bringing out the watered appearance was accomplished by the use of a diluted acid, which acts more upon the ground than upon the lines. The Zlatoosk weapons proved to be of properties similar to those of the old Damascus blades. Gen. Anosoff with one of them cut through floating gauze. Bones and nails may be cleft without injury to blades tempered for such use, and other steel tempered to the same point may be nicked by them without causing a gap. Their elasticity is so great that one may put his foot upon the end of the blade and bend it to a right angle, when it will fly back perfectly unchanged. Gen. Anosoff died in 1851, and his successor at the works failed to produce the remarkable blades for which the establishment had become celebrated.

**Damascus Iron, or Damascus Twist**, iron produced by the following method: Twenty-five alternate bars of iron and mild steel, each about 2 feet long, 2 inches wide, and  $\frac{1}{4}$  inch thick are united by welding; the *fagot* being drawn into a bar  $\frac{3}{8}$  inch square, is cut into lengths of 5 or 6 feet. One of these pieces is heated to redness, and one end is held firmly in a vice, while the other is twisted by a wrench or tongs, which shortens the rod to half its length and makes it cylindrical. If two of these twisted pieces are to be welded together, they are turned in diverse directions, one to the right and the other to the left; these are laid parallel to each other, welded and flattened. If three rods be used, the outside rods turn in a direction the opposite of the middle one, and this produces the handsomest figure. By these operations the alternations of iron and steel change places at each half revolution of the square rod, composed of 25 laminæ, the external layers winding round the interior ones; thus forming, when flattened into a ribbon, irregular eccentric ovals or circles. The fineness of the Damascus depends upon the number and thickness of the alternations.

**Damask**, a textile fabric, the ground of which is bright and glossy, with vines, flowers, and figures interwoven. At first it was made only of silk, but afterward of linen and woolen. According to the opinion of some, this kind of weaving was derived from the Babylonians; according to others, invented at a later period by the inhabitants of Damascus, from which latter place it is known to have derived its name. The true damasks are of a single color. In modern times the Italians and Dutch first made damask; and Europe was supplied, as late as the 17th century, from Italy alone, chiefly from Genoa. But the French soon imitated it, and now surpass the Italians. Damask is made in great quantities in Germany, chiefly in Upper Lusatia. *Dunfermline* is the chief seat of the manufacture of damask linen in Scotland, and *Lisburn* (q.v.) and *Ardoyne* in Ireland.

**Damask Designing and Manufacture.** To trace the origin of the art of weaving, or to ascertain the name of the artisan whose necessities led him to devise the crude appliance capa-

ble of being used in the production of even the very coarsest woven material, would be a hopeless task indeed, separated, as we are, from a period so exceedingly remote by the impenetrable gloom and obscurity which must ever enshroud the events of three or four score centuries ago. And yet we are safe in assuming that the ability to produce woven fabrics by means of a loom, no matter how elementary in construction, far antedates all written history, carrying us back to those early ages when the first rays of the sun of progress were faintly discernible above the horizon of time, awakening within our humble ancestors the desire for those things, which when obtained served to lighten their toil, and at the same time form part of the foundations of the noble structure, to which successive generations have contributed their share, and which we call civilization.

Coming down to a later period, however, we are enabled to gather authentic information regarding the degree of progress made in the art of weaving. Trustworthy records dating as far back as 2000 B.C. reveal the fact that the weavers of ancient Egypt were far advanced with the production of plain woven fabrics, many excellently preserved fragments of fine linen, which have been taken from the mummy cases of that period, testifying not only to the reverence with which they regarded the embalmed remains of their illustrious dead, but also to their skill and proficiency as weavers.

In the Bible also we find numerous references to the products of the loom. Job speaks of his days as being swifter than a weaver's shuttle (Job vii. 16). We also read that the draperies of the tabernacle and the veil of the temple were woven fabrics, richly embroidered with various colors. These allusions to the art of weaving, and others too numerous to mention, are scattered profusely throughout the pages of the sacred volume; while heathen writers of antiquity frequently allude to weaving as an art which was held in the highest esteem, and which furnished a favorite occupation for people representing every grade of society, from those who dwelt in the marble halls of princes down to the occupants of the most humble dwellings.

Nor was skill in weaving confined to one locality or people; an art so essential to the comfort and welfare of humanity at large, must speedily have become the common property of widely separated races; consequently we find that the Babylonish weavers of the year 1000 B.C. were celebrated for the richness and quality of their woven fabrics; while at the same period the patient Hindu and the stolid Chinese were producing fabrics of the finest texture on looms of the most primitive description.

From this it is obvious that the ancient races were familiar with the principles of fabric construction, and that they were able to produce a considerable variety of elementary weaves by using different varieties and counts of yarn in combination with each other; yet there is nothing to show that they were acquainted with any form of loom, the mechanism of which made possible the production of intricate floral or ornamental designs, such for example as could easily have been woven on the draw loom of a later period, or by its successor, the highly improved Jacquard power loom of the 20th century. This obvious drawback, however, they endeavored to overcome by means similar to those employed

## DAMASK MANUFACTURE

by modern manufacturers of textiles, who, in order to meet the demand for showy and inexpensive fabrics of a certain description, are accustomed to arrange either the warp or filling in the form of a series of stripes of contrasting colors, harmoniously arranged together or else by changing the color of both warp and filling at such intervals as a previously devised pattern indicates, are enabled to produce an extensive variety of checkered patterns.

Designs of this character the weaver of ancient times found no difficulty in creating, but any large ornate or floral patterns with which he was familiar, were obtained either by printing, or the skill of the embroiderer, or when considered desirable, a combination of both added to the woven material after it had passed from his hands, and which as a result cannot be classed with those fabrics, which, produced entirely on the loom, are valuable on account of the elaborate nature of the designs with which they are embellished, as much as by the costliness of the materials employed in their construction.

It will thus be seen that a loom which could only be used in the production of a comparatively restricted variety of designs was sure to be superseded sooner or later by one of a more highly developed type, which would allow the decorative instinct of the early textile artist greater opportunity to express the ideas suggesting themselves to him.

In due time a loom capable of accomplishing these results was invented, probably in China, where, like so many other relics of the long forgotten past, it may be seen in operation at the present day, although long since consigned to the rubbish heap in all progressive countries.

From China the draw loom, as it came to be called, found its way to other parts of the globe. But it remained for the weavers of the ancient city of Damascus, the capital of Syria, to develop the possibilities of the new loom to the utmost extent, with the result that in time they established a large manufacturing and export trade in the beautiful silken fabric which soon became widely known as damask, taking its name from that of the city to which for centuries it brought wealth and renown, and in the manufacture of which the Damascene excelled all competitors.

In regard to the fabric itself, it and various other weaves, now passing under the same name, will be analyzed and described farther on, but any detailed description of the now thoroughly obsolete draw loom would be out of place and of no value to the average reader, but those desirous of making a thorough study of the subject will find their curiosity gratified by consulting the excellent treatise on hand loom weaving by Murphy, published during the early part of the 19th century.

Stated as briefly as possible, however, it may be said that the draw loom tie-up was a compound arrangement, one part of the harness being controlled by a lad known as the draw-boy, the other part controlled by shafts for the purpose of subdividing the warp, so as to form the fine ground weave peculiar to damask fabrics. Just as the weaver was about to throw the shuttle across the lathe, the warp, of which there may have been five, six, seven, or more ends to each mail, according to the quality of damask desired, was raised *en masse* by the draw-boy

in accordance with the requirements of a previously painted pattern, all the remaining warp being left down. The shuttle would thus have passed under the warp raised and over the warp left down without interlacing or forming cloth, had it not been for the supplementary arrangement of harness shafts, through which the entire warp was drawn, for the purpose of enabling every end to be used separately.

For each pick one of these shafts would be raised and one depressed, the others remaining undisturbed, the shaft which had been raised lifting every eighth end from among the mass of warp left down, the shaft which had been depressed carrying down with it every eighth end from the mass of warp raised, while the shafts which remained in a neutral position were so constructed as to permit the lifting of one portion of the warp and the sinking of the remainder as called for by the design, without interfering with the shed or passage of the shuttle. By this means the pattern was formed and the warp and filling interwoven so as to produce an eighth shaft satin or any similar weave required.

During the wars of the Crusades the draw loom, along with many other things Oriental, found its way into various European countries, thereby aiding greatly the development of weaving as applied to silk damask, brocade, velvet, and other fabrics; the great artists of the Middle Ages not considering it beneath their dignity to supply the necessary designs for these rich textiles. For centuries, however, the draw loom remained practically the same as when first introduced, but in the year 1604 a Frenchman named Simblot devised a method by means of which the draw-boy was enabled to raise the warp while standing at the side of the loom, instead of the top, as had been the custom previously.

In England also, during the 17th and 18th centuries, patents were taken out for several devices intended to render the services of the draw-boy unnecessary; these, however, soon passed from public view, but the draw-boy remained, toiling away at his monotonous task for many a day after the mortal remains of Jacquard had crumbled to dust.

In the United States the manufacture of the finer grades of silk and cotton damask and upholstery fabrics in general is of comparatively recent origin, the vast majority of looms devoted to this industry being located in Philadelphia, with lesser numbers scattered throughout New York State, New Jersey, Connecticut, and Virginia.

Twenty-five years ago the business was in its infancy, but "mighty oaks from little acorns grow," and to-day the manufacture of upholstery goods is one of the most important industries of the country, which, with allied trades, such as yarn-spinning, dyeing, and the manufacture of textile machinery, provides the means of livelihood for tens of thousands of operatives, and at the same time is a standing monument to the business enterprise of the American manufacturer. Nor have we by any means reached the limits of our development in this direction; the remarkable inventive ingenuity of the American artisan, which in many other lines of business has practically placed him beyond the reach of competition, will not be likely to fail him when applied to the weaving industry.

## DAMASK MANUFACTURE

We will now consider the machine which time and experience has clearly demonstrated to be the most valuable contribution to the art of ornamental pattern weaving yet devised, and which owes its usefulness to the ingenuity of Joseph Marie Jacquard (an artisan of Lyons, France, born in the year 1752), although a large share of the honor bestowed on Jacquard is really due several others who endeavored during the early part of the 18th century to improve the draw loom. M. Falcon, for example, in the year 1728 invented a method of raising the warp by means of a chain of cards, on which a pattern was represented by holes perforated thereon, the cards being adjusted to a square cylinder also perforated to match a fully punched card. M. Vaucanson is also entitled to credit for improving the cylinder and causing it to revolve and move backward and forward with the cards. He also invented the griffe, which had for its object the raising of the warp; but these inventions, although constituting the essential features of the Jacquard machine, never passed beyond the realm of experiment until about the year 1801, when profiting by the experience of his predecessors after careful study of the problem, Jacquard introduced the machine which bears his name, and revolutionized the art of weaving.

The Jacquard machine may be defined as a piece of mechanism placed above a loom for the purpose of raising warp in any possible order a previously designed pattern may indicate.

The framework is of iron, strongly built, in order that the various parts may stand the strain to which they are subjected during the process of weaving. The steel hooks or wires which raise the warp are placed in an upright position, the needles occupying a horizontal position. Every needle is connected to a hook in such a manner that when the needle is pressed back by a card the hook is carried back also. A spring at the end of each needle sends both hooks and needles back to their original position. Each hook has a crook at the lower as well as the upper end. To the crook at the lower end the harness cords are fastened, and at the lower end of the harness cords the heddles are attached. In the centre of each heddle a small metal eye called a mail is fastened. Through the eye of the mail the warp is drawn. Below each heddle an iron weight called a lingo is attached for the purpose of keeping harness cord, heddle, mail, and warp in the proper position.

An important part of the machine is called the griffe. It is an oblong iron frame containing as many strips of iron called the bars, or knives, as there are rows of hooks lengthways in the machine. Each of these bars rests directly under the upper crooks of the hooks. The griffe has a rising and falling motion. When it moves upward it raises all the hooks whose upper crooks rest directly above the bars or knives, allowing those hooks which have been pushed aside by the card to remain down.

Another important part of the machine is the cylinder, on which the cards are carried backward and forward, to and from the points of the needles when the loom is in operation. It has four sides, each side being perforated with as many holes as there are needles in the machine, or holes in a fully punched card.

To control the movement of the hooks a pattern is painted on squared design paper. If it is to be woven by means of a 400 machine the designer cannot use more than 400 small squares from right to left on design paper; or, if the pattern is to be woven by a 600 machine, he cannot exceed 600, or 1,200 if made to suit a 1,200 machine, unless he makes use of hooks belonging to two extra rows, with which Jacquard machines are usually furnished. Neither is he compelled to use the full number of hooks available, as the pattern may be subdivided into two, four, six, or any number of parts required, but it would be necessary to paint out the full extent of the design unless the first part could be reproduced on an even number of rows, in which case the card stamper would go over the part painted as often as necessary, in order to indicate the complete number of harness cords on the card.

When the pattern has been completed it is given to the card stamper, who punches holes in the cards wherever the design indicates that warp is to be raised.

When the cards have all been cut they are laced together in regular rotation and placed upon the cylinder, around which they revolve in an endless chain. The loom is then started, and the cylinder carrying the cards with it moves toward the needle points, against which they are pressed. Where no holes have been punched, the card forces the needles back. The needles carry the hooks with them out of the way of the griffe bars, which rise at the same moment. This allows the warp to remain down, resting on the shuttle race, but where holes have been punched in the card, the needles enter, allowing the hooks to remain undisturbed, their upper crooks resting directly over the griffe bars, which, when rising, lift hooks, harness cords, and warp, forming a shed through which the shuttle passes.

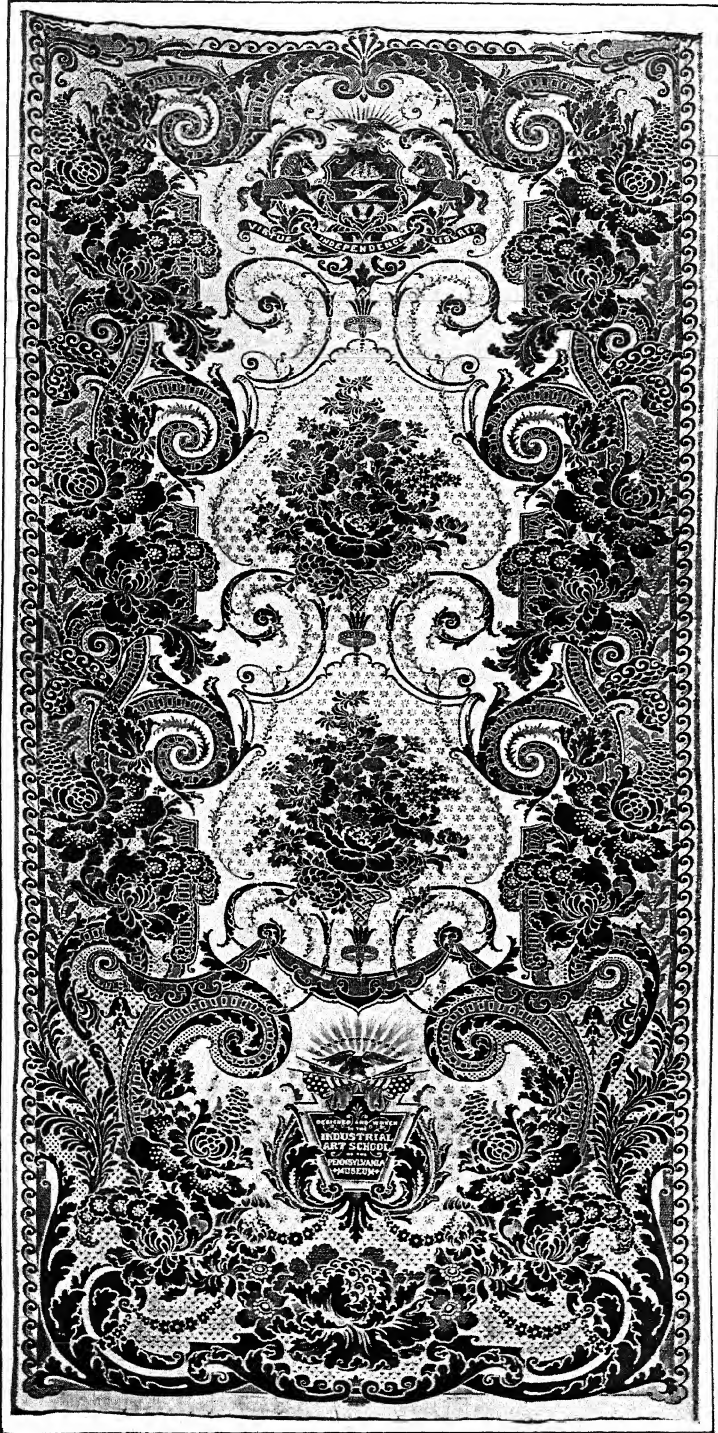
From this it will be evident that to raise warp, holes must be punched in the card, and where warp is to be left down, the card must be left uncut. The Jacquard machines generally used in the manufacture of upholstery fabrics range in capacity from 624 to 2,608 hooks. Within recent years a new machine known as the fine index Jacquard has come rapidly into favor. It is more accurately built than the older type known as the French index machine, and contains 80 full rows of 16 holes, and 24 extra holes on the peg hole rows, or a total of 1,304 holes on one card, a little larger than a 624 hook French index card.

For weaving fine damask goods, the machines generally used are known as double lift, single cylinder Jacquards, while manufacturers of such fabrics as turkey red damask table covers, use the double lift, double cylinder machine; another Jacquard called the rise and drop machine is also much used by upholstery goods manufacturers, these Jacquards being operated at a considerably higher speed than is obtainable with an ordinary straight lift, single acting machine.

In the double lift single cylinder machine, for example, there are double the number of hooks contained in a single lift Jacquard of the same capacity; although each has the same number of needles, there are also two griffes which work alternately, thus enabling the loom to be driven at a higher rate of speed, each griffe and the hooks it controls coming into operation at



# DAMASK.



Silk Damask Curtain. Designed by William Laird Turner. Exhibited by the Philadelphia Textile School at the Chicago World's Fair. 210 ends per inch. 120 picks per inch. Pattern on design paper covered 174 square feet. 28,320 cards required to form the design on cloth, which placed end to end would extend a distance of  $7\frac{3}{4}$  miles. The largest pattern designed in the United States, up to 1893.



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each alternate pick only, thereby avoiding unnecessary friction of both machine and warp.

In the double lift, double cylinder Jacquard, the pattern cards are divided into two sets, all odd-numbered cards being placed on one cylinder, and evenly numbered cards on the other. When the loom is in operation the cylinders come into play alternately, the odd cards and cylinder for the first pick, the even cards and cylinder for the second pick, and so on, each cylinder working at the rate of about 70 picks per minute, or 140 for both.

In addition to these machines there are a considerable variety of other makes adapted or modified to suit special conditions. The twill Jacquard, for example, designed to weave fine damask and other fabrics requiring a great number of warp ends with a machine of small hook capacity, the Jacquard in this case weaving both figure and ground, thereby greatly reducing the cost of designing and card-stamping. The cross border Jacquard is the name given to another style of double cylinder machine used for weaving table covers and border fabrics. In this case the cards for weaving the border are placed on one cylinder, and those forming the centre on the other, each cylinder being called into action to weave its own part of the pattern only.

Other varieties of machines might be mentioned, but those already referred to are sufficient to show that a Jacquard machine which might be perfectly adapted to a certain class of work would probably be of little use for anything else.

The "tie-up" is the technical term applied to the method by which the various harness cords controlling the warp are connected to the hooks of the machine, in order to form the elaborate patterns required for Jacquard woven fabrics in general.

The tying up may be accomplished in the three following ways: (1) By what is termed the straight tie method; (2) by the point or centre tie method; and (3) by those two methods in combination.

When the harness is tied up so that each end in the warp is controlled by a separate hook, it is known as a straight through single tie, which, for designing purposes is the best possible arrangement of the harness cords, as it enables the designer to execute a pattern extending from selvage to selvage without being compelled to repeat any portion unless found desirable. This method of tying up is rarely ever used, however, unless for narrow fabrics, or large panels woven in imitation of Gobelin tapestry, on account of the great expense it would necessarily involve for designing and card stamping, the manufacturer finding it much more economical to use the straight repeated tie, or the point tie, by means of which he could weave with a 1,200 machine, a damask or tapestry curtain, for example, containing 9,600 warp ends, in the full width of the fabric, by tying up the harness so that the pattern would be repeated eight times, to accomplish which the comberboard would require to be separated into eight equal divisions, each containing 1,200 holes and the same number of harness cords, the first cord from each division being connected to the first hook, the second cord from each division to the second hook, the third cord from each division to the third hook, and so on, so that by raising any

particular hook eight warp ends would be lifted, one from each division, all forming a portion of the design exactly alike, each in its own division.

From this it will be evident that the number of times a pattern may be repeated in the width of the fabric depends upon two things. In the first place, upon the number of hooks which the machine contains, and in the second place, upon the texture of the fabric to be produced, the finer the texture the greater the number of hooks necessary, in order to form a wide repeat.

The second tie-up referred to, the point, or centre tie, is generally adopted when the manufacturer desires a larger and more imposing style of design than is obtainable with the ordinary straight repeated tie.

For example, by using a 600 machine tied up straight, so as to give a warp texture of 100 ends per inch, the width of one repeat of the pattern would be limited to six inches, but by tying up the same number of ends per inch, using the point or centre tie method, the width of one repeat of the pattern would be 12 inches, and the number of harness cords and warp ends 1,200, controlled by 600 hooks.

This tie-up has one disadvantage, however, as it can only be used in the production of designs which are symmetrical, or alike on both sides of a line drawn from top to bottom, in the centre of the full repeat. In regard to the arrangement of harness cords for curtains, table covers, etc., for which this tie-up is much used, the first hook in the Jacquard machine is generally made to control two harness cords in the exact centre of the comberboard, the last hook controlling two harness cords, one of which is at the extreme left, and the other at the extreme right of the comberboard.

The combined point and straight tie is used principally for curtains, table covers, couch covers, and other fabrics requiring side borders, this method being adopted because the pattern repeat can be increased thereby. For fine weaves, however, a machine more limited in capacity than a 1,248 hook French index, or the 1,304 hook fine index Jacquard, will hardly be found serviceable, the 600 machine restricting the designer to very small patterns, which, while cheapening the cost of production a trifle on that account, and because fewer cards are required, would still be unprofitable, as the woven product could not compete with goods of the same texture ornamented with larger and more imposing designs; however, for cheap fabrics, such as turkey red damask, the 600 machine is commonly used, with the harness tied up to give a straight tie centre and a point tie border, with a warp texture of from 60 to 70 ends per inch, finished goods.

In medium grade fabrics the warp generally varies between 90 and 100 ends per inch, the 1,248 or 1,304 hook machine giving a curtain 50 inches wide, containing 4 straight repeats of 1,200 ends each, equal to 96 ends per inch, but as a curtain without a border is more or less unfinished, the machine could be used to greater advantage by dividing the hooks into two parts, the first 600 tied up point tie in three  $12\frac{1}{2}$  inch repeats, and the second 600 tied up straight, so as to give two borders, each six and a quarter inches wide, by which means the full width of 50 inches would be secured.



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For the finest fabrics where extensive single scale patterns are necessary, larger machines must be used, but if the cost of production must be reduced to a minimum, compound harness shafts may be used, with as many ends to each mail as are necessary to obtain the desired result.

When tying up has been completed, the loom is then ready for the warp, which for cotton damask and similar fabrics is generally delivered at the mill by the cotton spinner, undyed, and in chain form, spun to the counts or number wanted, the length of the chain and the number of ends it may contain varying to suit the requirements of different manufacturers, chains from 500 to 600 yards long and containing 1,200 ends being commonly used for 50 inch wide cotton damask fabrics, with a warp texture of 96 ends per inch, finished goods, a warp of this description requiring four chains, each containing 1,200 ends, in order to make up the full warp of 4,800 ends.

After the warp has been dyed the necessary color, it is sent to the beamer, who begins by taking the ends of the warp containing the pin lease, which he twists around several wooden pins on what is known as the rack, in order to regulate the tension with which it passes around another tension device, composed of three large hollow wooden rollers, or drums, as the beamers call them; the warp is then, by means of the pin lease, passed through the dents of a coarse reed suspended from the ceiling, then distributed over a second fixed reed to the required width, which is usually a little in excess of the width of the warp in the loom reed. Thence it is passed under two iron rollers, the second of which presses the warp down on the beam, causing it to go on firmly; it is then fastened to the beam, and the actual work begun, the beamer standing eight or ten feet from the beam, using the coarse hanging reed already referred to for the purpose of unraveling the warp, and causing it to pass through the fixed reed and on to the beam evenly, great care being exercised in order that all slack, crossed, or broken ends may be adjusted, this being absolutely necessary in order that the weaver may be saved annoyance and loss of time when the warp is in the loom.

The foregoing description applies to warps which can be beamed directly from the chain, but the warp for many varieties of cotton fabrics is not strong enough to stand the friction and strain of weaving, and requires different treatment previous to beaming.

Sea Island cotton, grown in the Fiji Islands, for example, has the longest fibre of any variety, the length of which runs from 1.25 to 1.90 inches, with the American variety of Sea Island cotton a close second, it varying between 1.60 and 1.80 inches, while Texas grown cotton is shorter in staple than any other variety, running between 0.70 and 0.95 inches. From this it will be seen that a single or slack twisted thread will be materially strengthened if coated with some starchy substance, the basis of which may be flour, starch, sago, or any other suitable medium. This is what is done, and the process involved is termed dressing the warp, special machines being required for the purpose.

Cotton, however, is not the only warp so treated. Linen warp for table damask is also dressed before beaming, the object being not only to enable it to stand the friction of weaving, but because by that means the cloth takes

on a superior finish, which is one of the desirable features of table damask, and which enhances its value accordingly.

In regard to silk, the most beautiful and costly yarn employed in the manufacture of textiles, it is extensively used both as warp and filling, in the finest grades of silk damask and brocades.

As it comes from the cocoon, or covering with which the silk-worm protects itself when in the chrysalis stage of its existence, it is too delicate to have any commercial value, but during the process of reeling four, five, or six threads are taken from as many cocoons and formed into one fine continuous thread, called singles, the reeling being accomplished by placing the cocoons in warm water, which softens the natural gum they contain and binds the group of separate strands into a single thread.

Tram silk is the name by which reeled silk filling yarn is known, two or more singles being loosely twisted together for that purpose.

Organzine is the name given to reeled silk warp yarn. It also is formed with singles, twisted separately, then doubled and twisted again, thus forming a remarkably strong and brilliant thread.

Spun silk is also in great demand for fine damask warps. It, however, has not the brilliancy of reeled silk, being formed with cocoons which have been pierced, or otherwise spoiled, and which, along with the refuse and waste accumulating during the reeling process, is torn up, then carded, and spun to the counts or number desired.

In regard to the warping and beaming of silk, it may be said that organzine and spun silk warp used in the fine silk damask trade, is bought in skein form, and in the gray, which, after being dyed, is wound on large bobbins, then transferred to the warping mills in sections, the creel on which the bobbins are placed not being large enough to hold all the bobbins necessary for the completion of the entire warp at one operation. After the warp has been put on the mill it is wound around the beam; when this is finished it is taken charge of by the twister, whose duty it is to twist the ends of the new warp to the corresponding ends of a short length of the old one which has been left in the loom for that purpose; but in the case of a new tie-up, or any change in the arrangement of the mails, which occurs when a straight tie for single warp fabrics is altered to suit a two or three warp weave, without cutting down the harness, the old warp would require to be taken out of the loom, and the new warp drawn through the mails and reed as required, before being ready for weaving.

Wool, jute, ramie, and other yarns are also used in the manufacture of damask fabrics, but the foregoing description will furnish a general idea of the warping, beaming, and twisting operations involved.

The next thing to be considered is the designing of patterns for Jacquard fabrics, this subject being one of vital importance to the manufacturer of high class ornamental textiles, the prosperity or decline of a business of this character depending in a great measure on the artistic ability of those responsible for each season's patterns.

Those unfamiliar with textile designing will probably imagine that the creation of new pat-

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terns lies entirely with the designer, which to a certain extent is true, but, generally speaking, the designer is the medium through which the ideas of the mill owner, manager, salesman, or other supposed expert find expression. If this important work is performed by a man of refined taste, in close touch with the trade, and always on the lookout for novel ideas in weave and design, if he is or has been a good original designer, and is familiar with fabric construction, so much the better. The business fortunate enough to possess a man with these qualifications will always secure its share of whatever trade is being done; but, unfortunately for some manufacturers, the designer is looked upon as of no more value to the firm than the man who oils a machine and keeps it running, while the head of the department may recently have been employed as a weaver or card-stamper, who, because of fancied executive ability, has been placed in charge of this important department, with the result that his first thought is to secure the cheapest men on the market, who produce work, which, from lack of proper training, he cannot perceive to be common and devoid of originality, and which, instead of creating dividends, will in time sap the foundations of what might have been, under proper direction, a profitable business.

Among small manufacturers the usual custom is to buy all patterns required from designers who work for the general public, but large concerns as a rule consider it more advantageous to employ a staff of draughtsmen, under the supervision of a head designer, who, in addition to ability as an artist, originator, and colorist, should be familiar with the Jacquard machine, the various methods of tying up, card stamping, and fabric construction. Men with these qualifications are not easily obtained, the technical man as a rule being of no use as an originator, while the designer capable of executing good original work, generally looks with indifference, if not contempt, on the various mechanical operations by which the design is transferred to the cloth, and fails to realize the importance of mastering these details until he finds himself outclassed by one who equals or excels him as an artist, and who, in addition, has burned the midnight oil, in order to acquire the technical knowledge which renders his services valuable.

When the designer is commissioned to prepare a pattern for any of the finer grades of Jacquard fabrics, silk damask furniture covering for example, he first prepares a rough charcoal sketch, drawing the figures the same size as they will appear in the cloth; when satisfied with what he has done, he takes a sheet of tracing paper and goes over the drawing carefully, making the outlines definite, and introducing improvements wherever possible. This carefully drawn tracing is then transferred to a sheet of drawing-paper, on which a background of a suitable color has been previously painted. When this is accomplished, the sketch is painted to resemble the finished cloth, after which it is left for the manufacturer or his representative to decide whether or not it shall be given to the draughtsman to transfer to squared design paper.

On the other hand, some manufacturers consider it a waste of time to prepare a painted sketch, and in the case of designs for many of

the coarser grade of textiles, and for one warp one shuttle weaves, such as cotton or linen table damask they are right, a shaded outline sketch being sufficient, but for silk damask and other high grade upholstery fabrics, where fine drawing and careful coloring are essential, a cloth-size painted sketch should always be prepared, not merely as a guide to the draughtsman and colorist, but because it is the only way to secure the best results.

After it has been decided that the sketch may be proceeded with, it is given to the draughtsman to transfer to squared design paper, the simplest and best way to accomplish which is by using the diverging scale, by means of which the sketch may be speedily and accurately ruled into as many squares as there are large squares in one full repeat of the pattern on design paper. Suppose, for example, that the sketch was for cotton damask goods, a 1,200 Jacquard machine being used, the cloth texture being 100 ends warp and 50 picks per inch, 1,200 hooks in one full repeat divided by 100 hooks per inch shows one repeat of the pattern to be 12 inches wide. The design paper necessary for the reproduction of this sketch may be 16x8, 12x6, 8x4, or any paper giving the proportion of 100 ends to 50 picks. Supposing that the draughtsman decided to use 16x8 paper, he would ascertain the number of squares into which the sketch should be ruled from left to right by dividing 1,200 by 16, which would give 75, that being the number of large squares in one repeat of the pattern, on design paper. Should this, in his estimation, cut up the sketch into too many squares, he could rule it into half that number, and mark the design paper to correspond.

When the sketch has been squared in this manner, the drawing is copied free-hand from the small squares on the sketch to the larger ones on design papers, this being continued until the whole pattern is reproduced in outline. It is then checked out with colors, representing those on the sketch, although generally brighter and more definite in hue in order that the card-stamper may have no trouble. When this has been accomplished the work of the designer and draughtsman is at an end, and the pattern is given to the card-stamper to be reproduced on the cards.

For a considerable time after the introduction of the Jacquard machine this was one of the most tedious and expensive operations connected with pattern-weaving, the first appliance for perforating the cardboard being simply a common hand-punch used in accordance with the requirements of the design, a second person reading the order of stamping for the guidance of the one who used the punch.

At the present day the cards are stamped by the piano machine, so called because in some respects it is supposed to resemble the musical instrument of that name, the design being placed on a reading-board in front of the stamper, while the keys which control the punches are operated by the fingers, and the card moved along from row to row by means of two pedals, manipulated by the feet. The machines used for stamping damask and other classes of upholstery fabrics are the French index, made to stamp 12 holes to each row, and the fine index, 16 holes to each row, the card guide in these machines being adjustable and self-centring,

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so that cards of different widths may be stamped thereon.

Before commencing to stamp from a design similar to that described, the card-stamper would rule the pattern into 100 divisions across, with lines drawn from top to bottom by means of a lead pencil, each of these divisions containing 12 small squares crossways to each line, corresponding to 12 holes in each row on the card, and 12 needles and hooks in the Jacquard machine, and the same number of ends of warp, the full 100 divisions corresponding to the 1,200 hooks forming the tie or repeat of the pattern, and all the various repeats in addition, by which the full width of the woven fabric is made up.

After the design paper has been ruled, the first half, corresponding to the first 600 hooks and ends, is placed in the reading frame and the work of stamping begun, the pattern being read from right to left, from the bottom line upward, each line corresponding to one pick on one-shuttle work, two picks on two-shuttle work, three picks on three-shuttle work, and so on. When both halves of the pattern have been stamped the cards are laced together by hand or machine, this work being generally executed by boys, who, when inexperienced, occasionally make mistakes by turning the cards around, or upside down, and lacing them when thus misplaced.

For example: a 600 Jacquard machine contains 52 full rows of holes, including the 2 extra rows; total, 624 hooks. If the cards are laced in proper rotation, but turned around so that the first hole in each card takes the place of the 624th, the position of pattern on the cloth would be reversed; that is, figures pointing to the right on design paper would point to the left on cloth, and *vice versa*. With some patterns this would make no difference, as for example, a design composed of two-sided figures, each side the reverse of the other, but should the pattern contain a motto, monogram, or initials, as is often the case with linen damask, to reverse the position of the letters would spoil them entirely.

Another mistake which occasionally happens completely destroys the pattern by cutting it into a series of disjointed stripes, running in the direction of the warp, is caused by lacing the cards in correct rotation, but upside down, thus putting the 12th row of holes in the place of the 1st, which, on a 12-row machine, would cause the 1st row of hooks to control the 12th row of harness cords, the 2d row of hooks to control the 11th row, and the 3d row of hooks to control the 10th row, and so on, which, occurring on every card, destroys the pattern in the manner described.

Genuine damask, the weaving of which will now be explained, may be distinguished from other damask fabrics, so-called, by the fact that both ground and figure are eight-shaft satin weaves, the ground formed by the warp and the figure by filling, or *vice versa*.

In the weaving of single-scale fabrics, each hook in the machine controls a separate harness cord, mail and warp end, in one repeat of the pattern, a 1,200 machine tied up to give 200 ends per inch would thus form a six-inch wide pattern, but if each hook were made to control two warp ends of the same counts, the pattern repeat would be extended to 12 inches, or 18 inches if three ends were used, 24 inches if four ends

were used, and so on, but as each group of ends is raised by a single hook, the outlines of the pattern are as a result coarser than if each end were controlled separately.

In order to form the fine ground weave it is necessary that the Jacquard harness be supplemented by an arrangement of shafts similar to those referred to when describing the draw loom; these shafts, which are placed between the reed and the Jacquard harness, have heddles containing extra long eyes, or loops, so that when occupying a neutral position the warp may be raised and depressed by the other shafts as the Jacquard harness is raising the warp in a mass to form the design. For example: when weaving a four-scale damask four ends are passed through each mail of the Jacquard harness, after which they are drawn separately through the heddles of the shafts in front, the first end through the first heddle of the first shaft, the second end through the first heddle of the second shaft, the third end through the first heddle in the third shaft, and so on, until the entire warp is drawn in. It will thus be seen that each shaft controls one eighth part of the entire warp and that if they are raised in proper rotation an eight-shaft satin will be formed.

The rising and sinking of these shafts is controlled by that part of the mechanism of the loom called the head motion, acted upon by the harness chain, certain balls called raisers and sinkers being arranged thereon, the raisers to lift and the sinkers to sink the shafts in the order necessary to form the weave, which for an eight-shaft satin may be as follows:

1st pick				1st shaft up, 5th shaft down.			
2d	"	4th	"	"	8th	"	"
3d	"	7th	"	"	3d	"	"
4th	"	2d	"	"	6th	"	"
5th	"	5th	"	"	1st	"	"
6th	"	8th	"	"	4th	"	"
7th	"	3d	"	"	7th	"	"
8th	"	6th	"	"	2d	"	"

One repeat of the ground weave is thus formed, and by raising and depressing the shafts in the same order for each successive pick the pattern and the exquisite satin weave for which fine damask is renowned, will be produced simultaneously.

The cost of production is greatly lessened by this method of weaving, as 4,800 hooks would be required to weave a pattern which could be produced by a 1,200 hook machine and a four-scale tie-up. It would also be necessary to paint the pattern on 4,800 small squares from right to left on design paper, as against 1,200 required by the four-scale tie, and if a fine index Jacquard is used, four cards would have to be stamped to represent every pick or line on design paper, instead of one as required by 1,200 hooks, thus giving the weaver four sets of cards to look after instead of one, all this additional labor and expense adding nothing to the value of the fabric beyond improving the outline of the pattern somewhat, which, however, for commercial purposes, would not justify the additional outlay, even if wholly practical.

When selecting the requisite design paper for these fabrics it must be remembered that a four-scale damask may contain 200 ends per inch, but as the entire number is controlled by 50 hooks, that number only must be considered. Should there also be 50 picks per inch, 8 x 8,

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10 x 10, 12 x 12, or any paper of the same proportion would be suitable. When painting the pattern, red could be used to represent figure, with the ground left white paper, and as the interlacing or stitching together of warp and filling is effected by the shafts, such would not require to be indicated on the design. The stamping of the cards is regulated by the method of weaving, which, in the case of fine silk damask, showing more ground than figure, is usually accomplished with the face of the cloth down, as this lessens the strain on the hooks and also on the lever which raises the griffe. For example: by weaving an eight-shaft satin face up, seven eighths of the warp would be raised and one eighth left down for every pick, but by weaving the cloth face down, one eighth of the warp would be raised and seven eighths left down for each pick, thereby reducing the strain on the machine to a minimum, and at the same time facilitating weaving. The card-stamper would therefore stamp red figure wherever indicated on the design and miss white.

Among the various fine damask fabrics may be mentioned a double-scale one-shuttle weave used principally for upholstering furniture, and which, in the finer grades, is composed of spun silk warp and tram silk filling. In this case each hook controls two ends in every repeat, the Jacquard harness raising both ends as one, while a set of shafts lifts each end separately in order to form the fine satin ground weave. To make this clear, it must be explained that the cloth is woven face down, and that the cards are cut to raise all the warp indicated by the figure painted red on design paper, while the ground warp represented by white is allowed to remain down. From the warp thus left down the shafts raise every eighth end, but as they do not sink any of the warp which has been raised, in order to allow the shuttle to pass under and form figure, the interlacing of warp and filling in the figure part of the fabric must be indicated on design paper, and represented on the card, with the result that at every point of interlacing two ends are left down, except where a shaft happens to lift one when forming the ground weave, but this is purely accidental, as the stitching of the filling by the warp is always done with the object of showing the silk to the best advantage, and while an eighth or sixteenth shaft satin form of stitching could be designed to suit the raising of the shafts, the floating of the silk filling on the face, one of the beautiful features of this fabric, would as a result be destroyed. This class of silk damask is also woven with two and three filling systems, by means of the same arrangement of Jacquard harness and shafts.

When woven with two systems of filling it is known as two-shuttle work, or three-shuttle work when three filling systems are used. When only two colors are used to form the design it is called a two-steady-shuttle pattern, to distinguish it from the same class of damasks in which one shuttle is steadily employed throughout the pattern, while the other is changed from one color to another a number of times in every repeat of the pattern during weaving, thereby cutting one of the filling systems into a series of horizontal stripes of colors, which the skill of the designer must soften and blend into harmony, by proper selection and skilful use of the steady color.

When selecting square design paper to suit a two-shuttle pattern, only half the total number of picks per inch are taken into consideration. For example: a total of 90 picks per inch on cloth would be represented by 45 lines on design paper, but as two cards would require to be stamped to represent the two picks indicated on each line, the full 90 picks per inch are thus made up. In regard to the warp texture, this varies a little, but 180 ends per inch may be considered about correct, and as 180 ends in a double scale tie-up are controlled by 90 hooks the design-paper selected should be in the proportion of 90 ends to 45 picks per inch, 16 x 8, 12 x 6, 8 x 4, or any similar paper would be suitable.

When selecting colors to represent the cloth effect on design paper, yellow may be used to represent the steady shuttle, and red to represent the changing shuttle, it being unnecessary to represent the changes on design paper if a properly executed sketch has been prepared, and also because a change in shuttle is represented by one card only. The background of the pattern should be left white paper, and the stitching on long filling face floats may also be indicated with white, although black or some other color is preferable on account of white having a tendency to peel off.

In this case the cloth would be woven face down, and the cards stamped as follows: First card yellow pick, stamp yellow, miss white, stamp red plain, that is, one end up and one down. Second card red pick, stamp red, miss white, stamp yellow plain.

Analysis of card stamping: First card, yellow pick. Stamping yellow raises all the warp represented on design paper by yellow, and allows the yellow pick to go under and form figure on the face, except where stitching takes place as indicated by white on yellow.

Missing white, allows the warp to remain down in a mass, wherever indicated on the design, except where ends are raised, at regular intervals, by the shafts to form the satin ground weave.

Stamping red plain, raises one half of the warp and leaves the other half down wherever red is indicated on the design, thus forming a plain weave with the yellow pick and the warp on the back of the cloth.

Second card, red pick. Stamping red raises all the warp represented on design paper by red, and allows the red pick to go under and form red figure on the face, except where stitching takes place as indicated by white on red.

Missing white, allows the warp to remain down in a mass wherever indicated on the design, except where ends are raised at regular intervals by the shafts, to form the satin ground weave.

Stamping yellow plain, raises one half of the warp, and leaves the other half down wherever yellow is indicated on the design, thus forming a plain weave, with the red pick and the warp on the back of the cloth.

The lifting of the shafts to form a satin ground weave is generally accomplished by means of certain rows of hooks reserved at each end of the machine for that purpose, the order in which they are raised being indicated on the corresponding rows at the ends of both cards.

Brocatelle is the name given to another variety of silk damask containing several ends to

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each mail. As originally woven, the warp was silk, and the filling silk, cotton, or wool. At the present time the term *brocatelle* is applied to a two-warp two-shuttle fabric used principally as furniture covering. Owing to the nature of the weave, the pattern, which may be formed by spun or organzine silk warp, on a tram silk filling ground, has a rich embossed appearance. The second warp, technically called the binder warp, may be either silk or fine cotton yarn, and is used for the purpose of stitching long floats of the tram silk pick on face and back, usually by means of four shafts forming a three-up and one-down straight twill; while the back pick is generally fine jute or linen the same color as the silk figure warp with which it forms an eight-shaft satin, also by means of shafts.

Designs for *brocatelle* should be treated in a bold conventional manner, with very little attempt at shading, which destroys the embossed effect of the pattern, and makes the fabric look cheap and common. The figure may be represented on squared paper by red, and the ground left white paper, and as the stitching on both picks is done by shafts, no indication of the same is required. The stitching of the silk pick by the binder warp is done by the head motion; but the satin weave formed by the silk figure warp and the backing pick, is indicated on certain rows at each end of the backing pick card, reserved for that purpose.

Brocade is the richest and most elaborate form of silk damask. It is structurally the same as the two- and three-shuttle damask referred to, but gold and silver filling are often used along with silk in order to enhance the beauty of the fabric.

In each case where reference has been made to the use of shafts they have been described as occupying a position at the back of the reed, and in front of the Jacquard harness, but during recent years a different method of using compound harness has come into use, the new shafts consisting of thin strips of wood hung lengthways, immediately below the Jacquard, and connected by means of cords to rows reserved at each end of the machine, for the purpose of raising them in satin order. The Jacquard harness cords are threaded through holes running from top to bottom of these shafts, so that when the Jacquard lifts, the cords are raised also without disturbing the shafts.

To illustrate: we will suppose that a 16-row fine index Jacquard is to be used for the production of double scale damask, with an eight-shaft satin ground. In this case the total number of ends in one repeat of the pattern would require to be divisible by eight, so that the satin might join at both sides of the repeat, and as the fabric desired is a double-scale weave, each row of 16 hooks would have to carry two shafts, equal to a total of 32 shafts, each controlling one thirty-second part of the warp, so that by raising four shafts in correct order for each pick an eight-shaft satin ground weave would be formed.

By using shafts in this manner there is less strain put upon the warp, as there is a separate harness cord and mail for each end, and no front shafts to trouble the weaver, who, as a result, will find it less difficult to tie in broken ends.

The cheaper grades of damask, embracing worsted hangings, table linen, cotton turkey red,

and several other one-warp, one-shuttle weaves are designed and woven on the same general principle, one hook controlling a single harness cord and end; in each repeat of the pattern the square design paper also being in proportion to the exact number of ends and picks per inch, one color on the design representing all the various satins, twills, and shadings of the cloth; while the cards are stamped, and the cloth woven face up, or face down, according to the nature of the particular weave.

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**Damaskeen'ing**, the art of inlaying iron or steel with other metals, especially gold and silver. It is also known as *damascene work*. This art is of great antiquity. Herodotus mentions a dish so ornamented; and the shields of some of the forces of the Samnites who fought against Rome were damaskeened. This method of ornamentation was formerly much used in Damascus and is found in modern Persian objects of art. The most beautiful specimens are produced by cutting into the metal with a graver and other tools proper for engraving on steel, and afterward filling up the incisions with a pretty thick gold or silver wire. The cuttings should be made in a dovetail form, so that the wire which is inlaid may adhere the more strongly. An inferior style of damaskeening can be produced by the electrotype process. The pattern is etched on the steel, and gold or silver deposited in the etched lines.

**Damasus**, the name of two popes. 1. SAINT DAMASUS I. was of the Hispanic race, born about 304, but from an early age he was employed as an inferior minister in the service of the Roman see. He was elected to the papacy 366; but as his election was displeasing to a strong faction in the city they set up a rival Pope, Ursinus. In a riot between the supporters of the two claimants of the papal chair in the Liberian Basilica, represented now by the Church of Santa Maria Maggiore, 137 persons, men and women, lost their lives; and Ammianus Marcellinus, the pagan historian, whose testimony is naturally hostile, declares that the ardor of the rivals to seize the episcopal seat surpassed the ordinary measure of human ambition. But ecclesiastical writers of the time make no mention of the 137 persons said to have lost their lives on this occasion, and its authenticity rests on the narrative of Ammianus alone. Prætextatus, the magistrate, who restored tranquillity to the city, is said to have remarked to the successful Pope, "Make me bishop of the city of Rome and I will straightway be a Christian." Damasus was on terms of intimate friendship with St. Jerome, who was his secretary and counselor, and it was at his pressing instance that Jerome made a new revision and translation of the sacred Scriptures. In his pontificate the Emperor Valentinian I., 370, enacted a law designed to correct a grave abuse which had arisen in the Church—the custom of priests and monks receiving from wealthy penitents, especially women, gifts and legacies for themselves. Valentinian's law now made such gifts and bequests void; further it forbade ecclesiastics and monks to frequent the houses of widows and virgins under severe penalties. It is said that Pope Damasus himself



suggested this law to the emperor, as a means of correcting the abuse at which it was aimed. St. Jerome mournfully confesses the shame he himself felt that the law should have been necessary: "It shames me to say it," he writes, "but idolatrous priests, jockeys (*aurigæ*), and play-actors, and prostitutes come into inheritances; only to clerks and monks is it forbidden by this law. And the prohibition emanates not from persecutors but from Christian princes. Nor do I complain of the law; but I grieve because we have deserved this law." Damasus died 384. His feast is observed 11 December. 2. DAMASUS II. was born in Bavaria, and at an early age was ordained a priest. Later he was consecrated bishop and received the appointment to the diocese of Brixen in Tyrol. In 1047 he was elected Pope, but lived only 23 days after being raised to the pontificate.

**Dam'bonite** ( $C_6H_6(NO_3)_6$ ), a white crystalline substance existing to the extent of 0.5 per cent in caoutchouc obtained from an unknown tree near the Gaboon, in Africa. It is extracted either by cautious sublimation, or by exhausting the dried juice with alcohol. It forms hexagonal crystals, without odor, but with a sweetish taste.

**Dambul**, *dām-bool'*, **Dambool**, or **Dambulla**, a village in the island of Ceylon, at the junction of four lines of road, 70 miles north-east of Colombo. It takes its name from the rock Dambul, a large mass of gneiss and mica schist which rises 550 feet above the surrounding plain, and contains a number of caves, one of them with a long inscription relating to the government of Ceylon in the 12th century, and another with a colossal statue of Buddha hewn out of the rock. The priests of Buddha still officiate in these cave temples.

**Dame** (Lat. *domina*, mistress), a title of honor which long distinguished high-born ladies from the wives of citizens and of the commonalty in general, and which still is the legal title in Great Britain of a baronet's or a knight's wife. In consequence of the greater courtesy shown toward women of higher rank, arose the custom of prefixing the word *ma* to *dame*, as a special proof of veneration and homage. Hence, too, the virgin-mother was called in France *Notre Dame* (*our lady*, as if no single Christian could exclusively claim the privilege of serving her with the homage of his heart). The daughters of the king of France, as soon as they came into the world, were called *madame*; and this was also the sole title of the wife of the king's eldest brother. In England, the word *dame*, though not much used, is now applied to married women of all classes. It is also applied particularly to the mistress of a small elementary school, especially if elderly and ignorant. *Madame* is shortened into *madam*, a usual term of address for ladies in general, but still also a word of honor, applicable, in particular cases, to majesty itself.

**Dame aux Camélias**, *La, lâ dām ô kâ-mâ-lê-â* (Fr. "The Lady of the Camellias"), a novel by Alexander Dumas the Younger, having for its heroine a certain real character, Margaret Gautier, belonging to the *demi-monde* of Paris. The novel appeared in 1848 and was published in dramatized form by Dumas in 1852. The English version of the play is known as 'Camille.'

**Dameron**, **Charles Emile**, *shârl â-mêl dâ-mê-rôn*, French painter: b. Paris 1848. He

was a pupil of Pelouse; and has won several medals, one at the Centennial Exposition at Philadelphia, in 1876. His works include: 'Pyramids'; 'Oaks of Grand Moulin'; 'Woodman's Cabin in the Autumn'; 'Valley of the Mantega'; 'Approaching Storm.'

**Dames of the Revolution**, an American society organized in 1896, and composed of women above the age of 18 years, of good moral character, and of proved descent from ancestors who, either as military, naval, or marine officers, or officials in the service of any one of the 13 original colonies or States, assisted in establishing American independence during the War of the Revolution, or between 19 April 1775, when the hostilities began, and 19 April 1783, when they ceased.

**Dame's Violet** (*Hesperis matronalis*), the only American representative of the genus *Hesperis*, of the natural order *Cruciferae*, or mustard family. The genus belongs to Europe and Asia, and the American plants have escaped from cultivation. The pale purple sweet-scented flowers are found in fields and on roadsides in southern New England, westward to Kansas, and also in North Carolina. Other common names, mostly from England, where it is a very common flower, are: Queen's or dame's gillyflower; night-scented gillyflower; damask violet, etc. The flower is extremely cultivated, and garden varieties are found in all tints from purple to white.

**Damiana**, *dâ-mî-â-nâ*, a drug derived from the leaves of South America, Mexican and Central American species of *Turnera*, especially *Turnera diffusa*. The botanical relationships of the various species are not well known. The chemical components consist of volatile oil, resin, and bitter principles, and the drug, therefore, acts as the aromatic bitters. It is widely used in many disreputable quack remedies that are practically worthless.

**Damiani**, *dâ-mê-â-nê*, or **Damianus**, **Petrus**, **Saint**, one of the fathers of the Church: b. Ravenna 1007; d. Fuenza 23 Feb. 1072. In infancy he was abandoned by his mother and then treated inhumanly by one of his brothers who gave him shelter, but another brother, Damianus, undertook his guardianship and gave him a good education. In gratitude, Petrus assumed the name Petrus Damiani, Damianus' Peter. For some years he conducted schools in Ravenna, but at the age of 30 joined a community of hermits and 1041 was elected to be their abbot. The renown of his piety, sanctity, and wisdom having spread widely, brought to his cell people high and low to entreat his prayers or his counsel, and popes and emperors did not disdain to solicit his advice. Made cardinal and bishop of Ostia, 1057, he prevailed on Benedict X., irregularly elected by the dominant faction of the Roman nobility, to resign 1058, and 1062 he induced the anti-Pope Honorius II. to forego his claims to the Roman see. He was an intensely zealous advocate of the reform of the Church and correction of the flagrant abuses which were widespread among the clergy in his time. In his manifesto, well styled by him 'Liber Gomorrhinus' (Book of Gomorrah), he exposes without regard to the dignities held by the offenders, the vices and the unspeakable enormities by which they brought discredit on the Christian profession. Had not the interests of religion de-

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manded it, such outspokenness would have been inexcusable and an offense against public morality. Another of his works bears the title, 'De Correctione Episcopi et Papæ' (of correcting a bishop and a Pope). All his life he practised the utmost austerities of the hermit. By decree of Pope Leo XII, his name was added to the roll of Doctors of the Church, and 23 February was appointed as his feast-day.

**Da'mianists, or Angelists**, disciples of Damian, the monophysite patriarch of Alexandria, in the 6th century. They professed a belief in only one nature in Christ. The Council of Chalcedon, in the 5th century, had condemned the heresy held by the Damianists in the 6th century.

**Damien, dā-mē-ān, Father** (JOSEPH DAMIEN DE VEUSTER), a Belgian priest: b. Louvain 3 Jan. 1840; d. Molokai 10 Aug. 1889. At an early age he decided to become a priest, and in time he found work in his chosen mission field in Honolulu. Here he heard from the bishop the neglected state of the lepers, some 700 or 800 in number, who lived on the small island of Molokai, and he volunteered to live and work among them. From 1877 onward he became physician of their souls and bodies, their magistrate, teacher, carpenter, gardener, cook, and even gravedigger at need. For a long time he worked on single-handed at his noble labors, but was finally joined by another priest. For 12 years he escaped all contagion of the fatal disease, though in constant contact with the sick and dying; but in 1885 the malady appeared in him. He continued unabated his heroic labors till very near his death. Consult: C. W. Stoddard, 'South Sea Idyls'; 'Lepers of Molokai.'

**Damiens, Robert François, rō-bār frān-swā dā-mē-ān**, French fanatic: b. Tieuloy, Artois, 1715; d. Paris 28 March 1757. He enlisted as a soldier, and was afterward a servant in the college of the Jesuits at Paris, but in 1738 left this service in order to marry. He then served in different houses of the capital, robbed one of his masters, a Russian, and saved himself by flight. His mind was disordered when he returned to Paris at the end of 1756. In the beginning of the next year he went to Versailles, took opium for two or three days, and prepared for the crime which he attempted 5 January. As Louis XV. was on the point of getting into his carriage Damiens stabbed him in the right side. The wound was of a trifling nature. Damiens did not attempt to escape. When questioned he said he never intended to kill the king, which he might easily have done. The most cruel tortures he bore with resolution, and could not be induced to confess that he had any accomplices. He asserted that he should not have committed the act had he been bled, as he requested, and that he thought it meritorious. He was condemned to be torn in quarters by horses, and the sentence was executed on the Place de Grève at Paris.

**Damietta, dām-ī-ēt'tā**, Egypt, town in Lower Egypt, on one of the principal branches of the Nile, 100 miles north-northeast of Cairo; lat. 31° 25' N.; lon. 31° 5' E. It is irregularly built, and contains some fine mosques, bazaars, and marble baths. Damietta was at one time a very important place, and carried on an extensive foreign trade, but is now eclipsed by Alexandria. A bar at the mouth of the Nile prevents large ves-

sels from reaching the town, compelling them to anchor outside, and to load and unload by means of small craft of from 30 to 60 tons burden. A military school and cotton-factory were established here by Mehemet Ali. The ancient town of Damietta (*Tamiāthis*) stood about five miles nearer the sea, or farther north. The danger to which it was exposed, however, from its position on the shores, induced the Egyptian caliphs to change its position, and to remove it to where the modern town now stands about the year 1251. The present town contains many antique columns and blocks, supposed to have been brought from the old city. It is the terminus of a railway from Cairo. Pop. 31,288.

**Dammar, dām'mar**, a resin derived from various plants, principally *Agathis dammara* and *A. australis*, both members of the pine family. These are natives of Molucca and the East India Islands, also of the Philippines and New Zealand. Dammar is exuded from the main stems and also from the roots of the plants. In some regions, notably in the mountains of Sumatra, the resin bursts forth in profusion from spontaneous fissures. In other regions artificial incisions are made in the trees, with a yield of resin correspondingly greater. Dammar comes into the market in large masses, or small pieces. It is yellowish, transparent when in small pieces, smooth and brittle, breaking with a clean, glassy fracture and it is readily reduced to powder. It is intermediate in hardness between colophonium and copal. Chemically it contains traces of ethereal oil, dammarolic acid and two resins. It is widely used in pharmacy and in the manufacture of varnishes.

The same name is applied in commerce to the resin of other and unrelated trees. Thus the dammar of shipyards is obtained from a species of *Canarium*, an amyridaceous tree, while black dammar is a kind of pitch derived from the allied *Marignia*. *Shorea robusta*, a dipteraceous tree, yields pitch and resin used in Indian dockyards, and sometimes also called dammar. Dammar is also occasionally confused with kinds of copal; thus, the resin of *Vateria indica* (*Dipteraceæ*) is sometimes known as dammar or piny dammar, of which the piny varnish of India is compounded. One of the Australian species, *A. robusta*, has been grown in some parts of California with fair success.

**Dammara**. A genus of coniferous trees now known as *Agathis*. See KAURI PINE.

**Dammood'**, a river in British India, which rises in the district of Ramghur and flows through Bengal, east, southeast, and south a distance of 350 miles. Rich deposits of coal and iron are found in its valley.

**Dam'ocles**, a native of Syracuse, and one of the courtiers and flatterers of the tyrant Dionysius the Elder. His name has become proverbial in consequence of a well-known anecdote related of him as illustrative of the uncertainty of human greatness and felicity. He had been extolling the grandeur and happiness of Dionysius, whereupon the latter invited him to a magnificent banquet, where he would be regaled with regal fare and royal honors. In the midst of the entertainment, however, Damocles happened to look upward, and perceived a naked sword suspended over his head by a single hair. The sight of this filled him with dismay, and

taught him at what a sacrifice of mental peace and personal security the enjoyments and splendors of royalty may be purchased.

**Dámodar**, dā-mō'dār, a river of Bengal, in India, which after a southeast course, flows into the Hugli, just above the James and Mary Sands and below Calcutta. A little below the mouth of its chief tributary, the Barákhhar, which it receives from the north, the Dámodar becomes navigable. The valleys of these two streams contain the coal-fields which produce about four fifths of the whole amount of coal mined in British India. Length about 350 miles.

**Da'mon and Phin'tias** (not PYTHIAS), two illustrious Syracusans, celebrated as models of constant friendship. Phintias had been unjustly condemned to death by Dionysius the Younger, tyrant of Sicily, but obtained permission to arrange his affairs in a neighboring place on condition that his friend should remain as a pledge of his return. Damon surrendered himself at the prison, ready to suffer death instead of Phintias if he did not return at a fixed time. Unexpected impediments detained him. Damon, still fully convinced of the faithfulness of his friend, was on the way to the place of execution, and the people began to murmur and to pity his credulity, when Phintias suddenly rushed through the crowd into the arms of his friend. While they demand each to die for the other, Dionysius himself approaches, pardons them, and entreats them to admit him a third in their friendship. Schiller has described this adventure in an excellent ballad, 'Die Burgschaft,' and it is the subject of a popular English tragedy.

**Damper**, a plate in an air-draft or flue, for the purpose of controlling the fire by regulating the area of the passage for the ingress or egress of air as the case may be. Dampers are of various forms. They are to the air-pipe or flue what the valve or faucet is to the duct for steam or liquids. The dampers of furnaces are either in the door of the ash-pit, to regulate the ingress of air, or in the course of or on top of the chimney, to close the egress of the volatile results of combustion. In the latter form they are used in almost all metallurgic furnaces.

In locomotive engines, a kind of iron venetian-blind, fixed to the smoke-box end of the boiler in front of the tubes; it is shut down when the engine is standing, and thus stops the draught and economizes fuel, but it is opened when the engine is running.

In pianofortes, certain movable parts, which are so arranged as to press upon the wires and check their vibration whenever the finger leaves the keyboard. Perfect damping is difficult to obtain, but when efficient it enhances brilliancy of execution and distinctness of harmony in a composition.

**Dampier**, dām'pēr, William, English navigator: b. East Coker, Somerset, June 1652; d. London March 1715. In 1673 he served in the Dutch war, and subsequently engaged in a band of privateers, as they called themselves, although in reality pirates, with whom he roved on the Peruvian coasts. Dampier, wishing to obtain some knowledge of the northern coast of Mexico, joined the crew of a Capt. Swan, who cruised in the hopes of meeting the annual royal Manila ship, which, however, escaped them. Swan and Dampier were resolved to steer for the East Indies, and they accordingly crossed

the Pacific, and after various adventures Dampier and others were left ashore on Nicobar Island. After making several trading voyages in the Eastern seas he entered as a gunner in the fort at Bencoolen. Upon this coast he remained until 1691, when he found means to return home. In 1697 he published an account of his voyage round the world, which had a great success, and was supplemented by a second volume in 1699. He now obtained command of a ship in the king's service fitted out for a voyage of discovery. In this he made important explorations on the coasts of Australia and New Guinea. Dampier's writings include: 'A Voyage Round the World' (1697); 'A Discourse of Winds' (1699); 'Vindication of the Voyage to the South Sea' (1707); 'Voyages to the Bay of Campeachy' (1729). They bear all the marks of fidelity; and the nautical remarks display much professional and even philosophical knowledge. His observations on natural objects are also extremely clear and particular.

**Dampier**, the name of several places in Australasia: (1) Dampier Archipelago, a cluster of about 20 small rocky islands off the north-west coast of Australia, in lat. 21° S., and lon. 117° E., divided by the Mermaid Strait in two groups; in the east is Rosemary, the largest island. (2) Dampier Island, off the northeast coast of New Guinea, with a volcano about 5,250 feet high. (3) Dampier's Land, a peninsula of western Australia, fertile and well watered, lying between King Sound and the Indian Ocean. (4) Dampier Strait, between New Guinea and the archipelago of New Britain, forming, with Goschen Strait to the southeast, the shortest route from eastern Australia to China by some 300 miles. (5) Dampier Strait, separating the island of Waigiu from the north-west extremity of New Guinea, the safest and easiest passage between the Indian and Pacific oceans.

**Damping-off**, the rotting of seedlings and cuttings in the seed-bed and the cutting bench, usually just above the surface of the soil. The immediate cause is a soil fungus (*Artotragus* or *Pythium debaryanum*) which feeds upon decaying organic matter until it obtains a favorable opportunity for attacking a living host. This opportunity is generally afforded by a weakened condition of the seedlings or cuttings due to a more or less stagnated atmosphere highly charged with moisture and of rather high temperature. The fungus gains entrance to the weakened stems which soon turn brown or black. The foliage quickly becomes infested and sometimes in a single night a whole seed-bed or bench full of cuttings may become a rotting mass with no healthy plants left. With careful management the trouble can be avoided. The propagating medium should be clean, sharp sand, which should be thoroughly drenched when the bed is watered, the excess water passing quickly away in perfect drainage. The bed should never be allowed to become dry. In short, both seedlings and cuttings should be kept growing steadily and sturdily. The drenching washes the spores of the fungus down through the sand. Should a bed become infested the healthy plants should at once be transferred singly and with as little soil as possible to fresh quarters. Neither freezing nor drying



## DAMPS — DAN

the soil will kill the fungus, which can live for months when growth is impossible. Sterilizing the sand or soil with steam is sometimes resorted to, the sand being heated for several hours. Less frequently plants in the open air are attacked. In the greenhouse and nursery experience in management will count for much.

**Damps**, certain deleterious gases which are released in mines. They are distinguished by miners under the names of choke-damp and fire-damp. The former is found in the deepest parts of mines. It extinguishes candles, and often proves fatal to human life. It consists for the most part of carbonic acid gas. The fire-damp, which prevails almost exclusively in coal-mines, is a mixture of light carburetted hydrogen and atmospheric air, and explodes violently whenever it comes in contact with flame. The gas or after-damp which remains in a mine after an explosion is a kind of choke-damp, and consists of a mixture of carbonic acid gas—produced by the combustion of the carburetted hydrogen—and the nitrogen of the air. It is of course fatal. The accidents which formerly occurred so frequently both to the machinery and to miners, arising from the fire-damp, are, if due precaution is used, obviated by Sir Humphry Davy's safety-lamp. This lamp consists of a cylinder of wire gauze, about four inches in diameter and one foot in length, having a double top, securely fastened by doubling over to a brass rim, which screws on to the lamp itself below. The whole of the wire gauze is protected and rendered convenient for carrying by a triangular wire frame and a ring at the top. The wire gauze is made either of iron or copper, the wire being at least one thirtieth of an inch in diameter, and woven together so as to leave 625 apertures in a square inch. The body of the lamp is of rivetted copper, or of massy cast brass or cast iron, the screws fitting so completely as to leave no aperture into the body of the lamp. When the lamp is lighted, it affords the miner all the light which he requires, and renders him perfectly secure, even though entirely enveloped with the gaseous mixture which, with an ordinary light, would immediately explode. The first effect of the fire-damp atmosphere is to increase the length and size of the flame. When the carburetted hydrogen forms as much as one twelfth of the volume of the air, the gauze cylinder becomes filled with a feeble blue flame, but the flame of the wick appears burning brightly within the blue flame, and the light of the wick expands until the inflammable gas increases to one sixth or one fifth, when it is lost in the flame of the fire-damp, which now fills the cylinder with a pretty strong light. As long as this explosive mixture of gas exists in contact with the lamp, so long it will give light; and when it is extinguished, which happens when the foul air constitutes as much as one third of the volume of the atmosphere, the air is no longer fit for respiration; for though animal life will continue when flame is extinguished, yet it is always with suffering. A coil of platinum wire being fixed above the wick of the lamp, within the gauze cylinder, the metal continues to glow long after the lamp is extinguished, and affords a sufficient light to enable the miner to make his escape. The effect of the safety-lamp is supposed to depend on the cooling agency of the wire gauze, exerted on the portion of gas burning within the cylinder. Hence a lamp may

be secure where there is no current of an explosive mixture to occasion its being strongly heated, and yet not safe when the current passes through it with great rapidity. But any atmosphere, however explosive, may be rendered harmless by increasing the cooling surface, which may be done either by diminishing the size of the apertures, or by increasing their depth, both of which are perfectly within the power of the manufacturer of the wire gauze.

**Damrosch**, dām'rōsh, **Frank**, American musician: b. Breslau, Prussia, 22 June 1859. He was trained by his father, Leopold (q.v.), and in 1882 became conductor of the Denver Chorus Club and supervisor of music in the public schools of that city. He was chorus master at the Metropolitan Opera House, New York, from 1885 to 1891, and in 1892 organized the People's Singing Class. Since 1897 he has been supervisor of music in the public schools of New York.

**Damrosch**, Leopold, German musician: b. Posen, Prussia, 22 Oct. 1832; d. New York 15 Feb. 1885. He was graduated from the University of Berlin, and began the practice of medicine; but his love for music predominated, and in 1864 he gave up his medical profession and started on a tour as violinist. He met with great success and on his return to Posen was appointed musical director at the Stadt Theater. He subsequently held a similar post in Breslau. Coming to the United States, he was made leader of the Arion Society in New York, and subsequently founded the Oratorio and Symphony societies of that city.

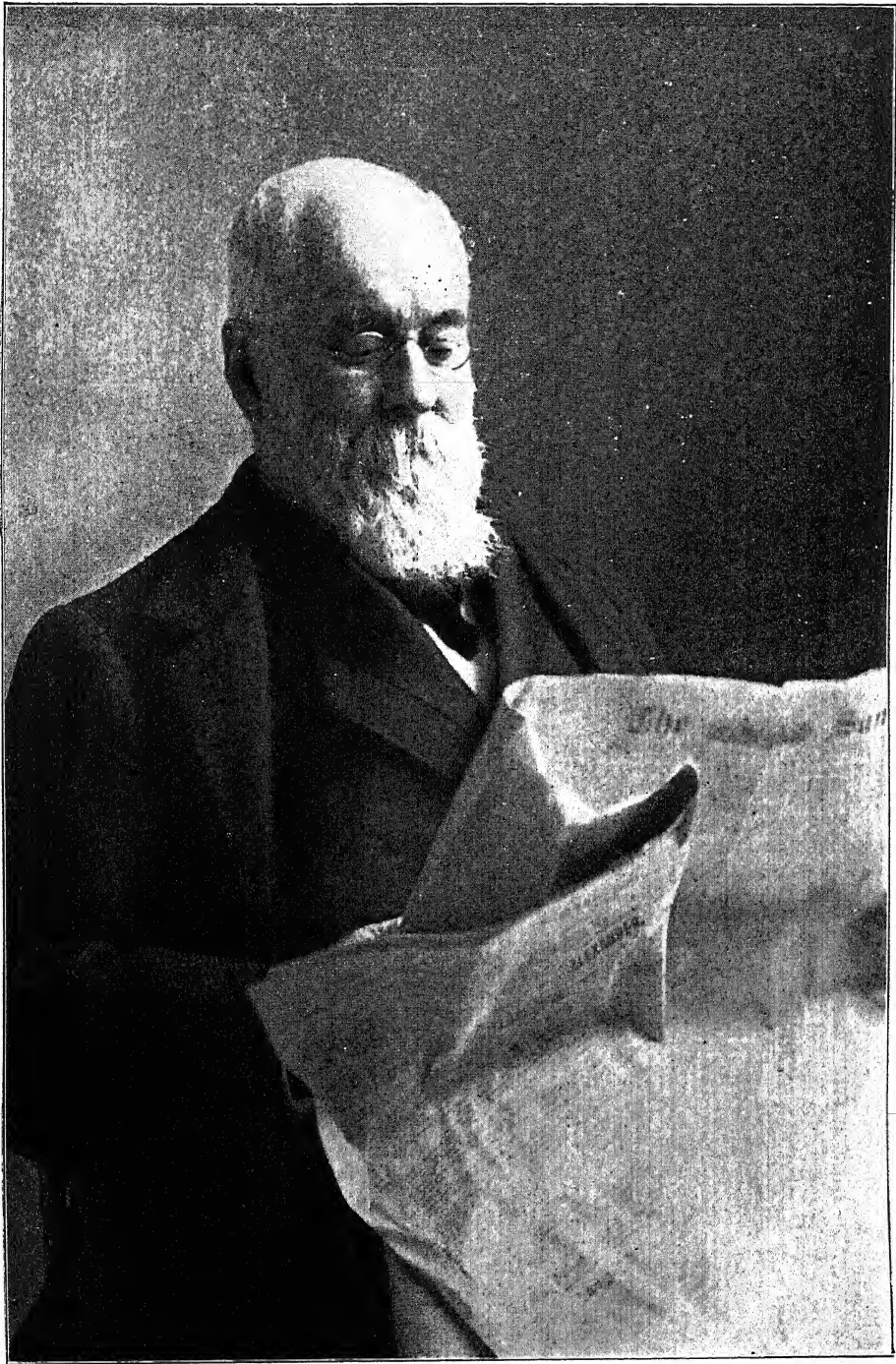
**Damrosch**, Walter Johannes, American musician: b. Breslau, Prussia, 30 Jan. 1862. He is a son of Leopold Damrosch (q.v.), and has been a citizen of the United States since 1871. He inherited the musical talent of his father, and succeeded him in his enterprises. He is the special exponent of the Wagnerian school of music, and has conducted operatic performances in all the large cities, proving himself a most acceptable leader. He has also written an opera founded on Hawthorne's tale of 'The Scarlet Letter,' besides other excellent music.

**Dams**. See RESERVOIRS.

**Damsel-fly**, sometimes, though rarely, used as a popular name for the common dragon-fly, or mosquito-hawk, of the neuropterous family *Libellulide*. Damsel-fly is the English equivalent for the French *demoiselle* (fly) which is applied only to the genus *Agria*. This is a very small dragon-fly, not half as large as *Libellula*. Its metallic greenish-blue color and slender delicate form produce a beautiful effect in the sunshine, and suggest the name. See DRAGON-FLY.

**Damson**, a variety of plum (q.v.).

**Dan** (Heb. "judgment"), one of the sons of Jacob by his concubine Bilhah. Like the other sons of Jacob, Dan became head of one of the 12 tribes of Israel. At the time of the exodus the Danites numbered 62,700 adult males. The territory assigned them in Canaan lay on the coast, but living in the immediate neighborhood of the hardy and well-equipped Philistines—for the district lay partly within the Philistine territory—the available land proved somewhat too narrow for the Danites, and they were pushed back into the more mountainous region,



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## DAN RIVER—DANA

where they encroached on the boundaries of Judah. The tribe also possessed an isolated portion of territory in the extreme north of Canaan, containing the town of Laish or Dan, which gave rise to the proverbial expression "from Dan to Beersheba." This town was in later times selected by Jeroboam as one of the two centres of his idolatrous worship, but a species of idolatry had been maintained there from the earliest times of the settlement in connection with the image of Micah. The most notable person connected with the tribe was Samson.

**Dan River**, a river rising in Patrick County, Virginia, flows across the boundary between Virginia and North Carolina a number of times, but finally unites with the Staunton River, at Clarksville, Va., and forms the Roanoke. The river is somewhat less than 200 miles in length, and furnishes valuable water power in its upper part. It is navigable for about 100 miles above the junction with the Staunton River.

**Dana, Charles Anderson**, American journalist: b. Hinsdale, N. H., 8 Aug. 1819; d. Glen Cove, L. I., 17 Oct. 1897. He was educated at Harvard and in 1842 was a member of the Brook Farm Community, in Roxbury, Mass., remaining there only two years. He edited 'The Harbinger' (1844-7), his associates being George Ripley, Parke Godwin, and John S. Dwight. In 1847 he became managing editor of the New York *Tribune*, with which he remained until 1861. In 1855, with George Ripley, he projected and edited Appleton's 'American Encyclopædia' in 16 volumes, completed in 1863, and revised in 1873-7. He also edited several other works, among them the popular 'Household Book of Poetry' (1857). From 1862 to 1865 he was in the service of the United States government, during the last two years as assistant secretary of war under President Lincoln. About the beginning of 1866 he became editor of the Chicago *Republican*, a daily paper. In 1868 he purchased an interest in the New York *Sun*, also a daily, of which he was editor and chief proprietor until his death. He was a man of forcible character and impressed his personality upon his paper. His literary judgments and perceptions were keen and his own writing exhibited a perfect mastery of English style. Under his management the *Sun* became noted for the literary quality of its editorials. In his later years, however, his intense political partisanship became very marked and greatly diminished the weight of his influence in journalism.

**Dana, Charles Loomis**, American physician: b. Woodstock, Vt., 25 March 1852. He was graduated from Dartmouth College in 1872, studied medicine and has been professor of nervous diseases in Dartmouth Medical College, and at the medical department of Cornell University. He has published 'Text Book of Nervous Diseases' (1892).

**Dana, Edward Salisbury**, American mineralogist: b. New Haven, Conn., 16 Nov. 1849. He was graduated from Yale in 1870 and has been a member of the faculty at that institution from 1874, at present (1903) as professor of physics. He has published: 'A Text Book of Mineralogy' (1877); 'Text Book of Mechanics' (1881); 'Minerals, and How to Study

Them'; 'Sixth Edition of James D. Dana's System of Mineralogy' (1892).

**Dana, Francis**, American jurist: b. Charlestown, Mass., 13 June 1743; d. 25 April 1811. He was a son of Richard Dana (q.v.), was graduated at Harvard in 1762, and admitted to the bar in 1767. In 1775 he was sent to Europe on a confidential mission to Benjamin Franklin, carrying letters from Warren, Quincy, and other patriots. He returned the next year and reported to Gen. Washington that the colonies need expect nothing of Great Britain. In 1777 he was elected a member of the Congress that formed the Confederation, and filled various offices during the Revolutionary War. In 1781 he was made minister to Russia, and after his return was again elected to Congress. In November 1791 he was appointed chief-justice of Massachusetts for a term of 15 years.

**Dana, Francis**, American lawyer and author: b. Singapore, East India, 4 March 1866. He was educated at Saint Paul's School, Concord, N. H., and the Harvard Law School, and besides contributing short stories to periodicals has published 'Lenora of the Yawmish.'

**Dana, James Dwight**, American naturalist: b. Utica, N. Y., 12 Feb. 1813; d. New Haven, Conn., 14 April 1895. He was graduated at Yale College in 1833; accompanied the American expedition of 1838 to the Southern and Pacific oceans as geologist and mineralogist, and on his return compiled exhaustive reports. In 1835 he became Silliman professor of natural history and geology at Yale, but in 1864 the title was altered to that of professor of geology and mineralogy. Many American and foreign learned bodies conferred distinctions on him. Besides many articles in various journals, he wrote: 'System of Mineralogy' (1837); 'Manual of Mineralogy' (1848); 'Coral Reefs and Islands' (1853); 'Manual of Geology' (1863); 'Text-Book of Geology' (1864); and 'The Geological Story Briefly Told' (1875).

**Dana, John Cotton**, American librarian: b. Woodstock, Vt., 19 Aug. 1856. He was graduated at Dartmouth College 1878, and admitted to New York bar 1882. He was librarian of the Public Library, Denver, Col., 1889-97; of the City Library Association of Springfield, Mass., 1898-1901, and has since been at the head of the Public Library of Newark, N. J.

**Dana, Marvin**, American writer: b. Cornwall, Vt., 2 March 1867. He has published: 'Mater Christi and Other Poems'; 'History of Gen. Custer'; 'History of the Mormons'; 'Wars of the Century'; 'Studies in Criminology'; 'A Brief Universal History.'

**Dana, Napoleon Jackson Tecumseh**, American soldier: b. Eastport, Me., 15 April 1822. He was graduated from West Point in 1842, served in the Mexican war and in the Civil War also, becoming major-general. He resigned from the army in 1865 and has since engaged in mining enterprises, and been president of several railroads.

**Dana, Paul**, American journalist: b. New York 20 Aug. 1852. He is a son of C. A. Dana (q.v.), and was educated at Harvard and the Columbia Law School. He began journalism on his father's paper, the New York *Sun*, and after the latter's death in 1897, was for several years its editor-in-chief.

**Dana, Richard**, American jurist: b. Cambridge, Mass., 7 July 1699; d. 17 May 1772. He was a grandson of Richard Dana, the first of the family who came from England and settled at Cambridge in 1640. After practising law at Marblehead and Charlestown, he removed to Boston, where he became a leading barrister. He was distinguished for his prominence in the measures of resistance which immediately preceded the American Revolution. Although devoted to his profession and declining office, he was a leading figure in those important political assemblages, where he sometimes presided, the Boston town meetings from 1763 to 1772. It was the custom of Boston in those troubled times to address the country at large on public affairs under the form of published instructions to the representatives of the town. Warren, Hancock, and the Adamses were on committees for this purpose. Dana was always a member, and often at their head. He reported the papers of 20 Nov. 1767, and 8 May 1770, noted at that time. He was a member of the association of the Sons of Liberty, and at their celebrated meeting of 17 Dec. 1769, administered to Secretary Oliver the oath of non-execution of the Stamp Act, and made and signed a solemn official record of that fact, by which he would seem to have exposed himself to the charge of treason under the constructions of those days.

**Dana, Richard Henry**, the Elder, American poet and essayist: b. Cambridge, Mass., 15 Nov. 1787; d. Boston 2 Feb. 1879. He was a son of Francis Dana (1743-1811 q.v.); studied at Harvard College and was admitted to the Massachusetts bar in 1811. He was connected with the 'North American Review' from its commencement in 1815, and his earliest writings first appeared in that periodical, of which he became joint-editor in 1818. His lectures on Shakespeare's characters, delivered in the principal cities of the Atlantic coast (1839-40), awakened a deep public interest. His principal poems are: 'The Change of Home' (1824); 'The Dying Raven' (1825); 'The Buccaneers' (1827), specially noteworthy for its descriptions of the vicissitudes of ocean scenery. To a periodical publication, 'The Idle Man' (N. Y. 1821-2), of which he was editor, he contributed critical papers and several stories; among them 'Paul Fenton' and 'Edward and Mary.'

**Dana, Richard Henry**, American jurist and miscellaneous writer: b. Cambridge, Mass., 1 Aug. 1815; d. Rome, Italy, 7 Jan. 1882. He was a son of the preceding. He entered Harvard College in 1832, but compelled on account of an affection of the eyes to suspend his studies in 1834, he undertook a voyage to California in the capacity of a common sailor. This voyage he described in a very interesting book, 'Two Years Before the Mast' (1840, enlarged edition 1869). Returning to college he completed his law course, and was admitted to the Boston bar in 1840, soon securing a large number of admiralty cases. In 1841 he published a treatise on seamanship, 'The Seaman's Friend' (republished in England as 'The Seaman's Manual'), containing a treatise on practical seamanship, a useful dictionary of sea terms, and valuable information on maritime law. In 1859-60 he made a voyage round the world, visiting the Sandwich Islands, China, Japan, Ceylon, India, and Egypt, returning

through Europe. In 1861 he was appointed United States attorney for Massachusetts, and was counsel for the United States in the proceedings against Jefferson Davis for treason, in 1867-8. In 1866 he published a copiously annotated edition of Wheaton's 'Elements of International Law.' See Adams, 'Richard Henry Dana: a Biography' (1890).

**Dana, Samuel Luther**, American chemist: b. Amherst, N. H., 11 July 1795; d. Lowell, Mass., 11 March 1868. For more than a generation he was employed as chemist in the Merriam Print Works in Lowell, and while there invented a new method of bleaching cotton goods which was very widely adopted.

**Dana, William Parsons**, American marine artist: b. Boston, Mass., 18 Feb. 1833. He studied in Paris under Picot and Le Poitevin, became a member of the National Academy in 1863 and obtained a third class medal at the Paris Exhibition of 1878 for his 'Gathering Seaweed.' One of his most noted pictures is the 'Chase of the Frigate Constitution,' now on exhibition in a private art gallery in New York city.

**Dana, Mrs. William Starr.** See PARSONS, FRANCES THEODORA STARR.

**Danaë**, dā'nā-ē, in Greek mythology, daughter of Acrisius, king of Argos. She was shut up by her father in a brazen tower, because an oracle had declared that a son of his daughter should put him to death. But Zeus, inflamed with passion for the charming virgin, transformed himself into a golden shower, and descended through the apertures of the roof into her embraces. When Acrisius discovered that his daughter had become a mother he exposed her with her child, in a chest, to the violence of the waves. But the sea-goddesses, anxious for the preservation of the son of Jove, commanded the billows to bear the box safely to Seriphos, one of the Cyclades. Polydectes, or rather Dictys, the governor of the island, received her, and educated the child, which he named Perseus.

**Danaï.** See DANAUS.

**Danaïs**, dā'nā-īs, a genus belonging to the group *Nymphalidae* (by some placed in *Papilionidae*), the largest family of day-flying lepidopterous insects, widely scattered over the globe. *D. crippus* (or *archippus*) is prevalent in all parts of the United States. Its wings are variegated with yellow, black, and white bands, and it occurs frequently in summer along country roads, in pastures, and wherever the milkweed, its favorite food, grows. The chrysalis is well known for its beauty of green and gold. The caterpillar is marked with yellow and black bands. *Danaïs* is a famous globe-traveler, having spread by some unknown means from continents to islands of the ocean, and to Australia. Very beautiful species abound in India. In New Holland it was found that the natives, who called it "bugong moth," valued it highly for food. By means of smothered fires they were able to suffocate and collect the "moths" in large quantities, after which the appendages were removed and the bodies were made into oily cakes.

**Danakil**, dā-nā-kēl' (singular DANKALI), the Arabic and now general name for the numerous nomad and fisher tribes inhabiting the coast of northeast Africa, from Massowah south to

## DANAO — DANCE OF DEATH

Tajurrah Bay, and from there southwest to Shoa. They belong to the Ethiopic Hamites, and are well built and slender, with features indicating an intermixture of Arab blood. In a country of waterless plains, they are generally nomads, living partly by caravan traffic and the slave trade, but mostly on the milk of their flocks.

**Danao**, Philippines, (1) town on the east coast of the island of Cebú, four miles north of Compostela, and 18 miles north of the town of Cebú. The productions of the interior are important for exports, but the anchorage at Danao is not good enough to encourage steamers to load at this port. The road along the coast is in a good condition. Pop. 15,483. (2) Danao, a hamlet, is on the west coast of South Antique, Panay, four miles north of Dao. (3) A lake in West Leyte, south of Panangua crater. (4) A mountain peak on the island of Luzon. (5) A river in the northeast of Negros Occidental, rising in the crater of Solitario, flows east into a small bay, on the north shore of which is situated Escalante.

**Dan'aus**, in Greek mythology, the son of Belus and twin-brother of Ægyptus, originally ruler of Libya. Fearing his brother, he fled to Argos, with his 50 daughters, the Danaïdes, and here he was chosen king, in place of Gelanor. The 50 sons of Ægyptus followed him, and under the pretence of friendship, sought the hands of his daughters in marriage. Danaus consented, but on the bridal night he gave his daughters each a dagger, and urged them to murder their bridegrooms in revenge for the treatment he had received from Ægyptus. All did so, except one, Hypermnestra, who allowed her husband, Lynceus, to escape. The fable states that in the under-world the Danaïdes were compelled, as a punishment for their crimes, to pour water for ever into a vessel full of holes. From Danaus, the Argives were called Danaï.

**Dan'bury**, Conn., city and one of the county-seats of Fairfield County; on the New England, and the New York, New Haven & Hartford railroads; 62 miles northeast of New York. It is the greatest hat-making city in the United States, with nearly 30 factories in operation. It has also extensive manufactures of iron, brass, and silverplated ware, bicycles, paper, and foundry and machine shop products. There are a court-house, public library, high school, public parks, electric street railways and lights, soldiers' monument, two national banks, daily and weekly newspapers, and excellent public and private schools. A temporary settlement was made here in 1684, a meeting-house was erected in 1696, and for many years the place was known by the Indian name of Paliquioque. In 1776 the place was made a depository for army stores, and when Gen. Tryon, the British governor of New York, was informed of the fact he headed a force of over 2,000 men, landed at Norwalk, marched immediately upon Danbury, and set fire to the town and stores. Hat-making was begun here in 1780. Pop. (1900) 16,537.

**Danby, Francis**, Irish painter: b. Wexford, Ireland, 16 Nov. 1793; d. Exmouth, Devonshire, England, 17 Feb. 1861. He studied at the Dublin Academy of Fine Arts, and sent to its exhibition his first picture in 1812. In 1820 he settled at Bristol, established his reputation in 1823 by his 'Sunset at Sea After a Storm'; and

in 1825, by his 'Delivery of Israel out of Egypt,' obtained the honor of being admitted as an associate of the Academy. Among his subsequent pictures the most celebrated are the 'Opening of the Sixth Seal' (1828); the 'Age of Gold' (1831); 'The Enchanted Island—Sunset' (1841); 'The Contest of the Lyre and Pipe in the Vale of Tempe' (1842); and the 'Painter's Holiday' (1844). Danby's excellence lay in his delineations of scenery, and the poetic halo with which he contrived to invest them.

**Danby, Thomas Osborne**, DUKE OF LEEDS; English statesman: b. 1631; d. 26 July 1712. A favorite of Charles II., he became lord treasurer in 1673 and was made Earl of Danby the next year. He was instrumental in bringing about the marriage of the Duke of York's daughter, Mary, to the Prince of Orange, and on the accession of William III. was appointed president of the council, and in 1694 was created Duke of Leeds.

**Dance of Death**, a grotesque allegorical representation in which the figure of Death under various forms takes the lead, followed by dancers of all ages and conditions. It was frequently drawn by artists of the Middle Ages for cemeteries and cloisters. These representations were common in Germany, and also in France, where they received the name of *Danse Macabre*. This term is supposed by some to be derived from the Arabic *magbarah*, a cemetery, but much more probably from the *Chorea Machabæorum*, or dance of the Maccabees, a kind of dramatic representation performed in the Middle Ages, in which the seven martyred brothers mentioned in the second book of Maccabees (Apocrypha) would appear to have been introduced. A Dance of Death was painted on the walls of the churchyard of the Innocents at Paris, about the middle of the 15th century, which the chapter of St. Paul's in London caused to be copied, to adorn the walls of its monastery. Gabriel Peignot, in the 'Recherches sur les Danses des Morts et sur l'Origine des Cartes à jouer' (Dijon and Paris 1826), investigated the origin of the Dance of Death in France, and explained the dancing positions of the skeletons, by the fact which old chronicles relate, that those who were attacked by the plague ran from their houses, making violent efforts to restore their rapidly declining strength by all kinds of morbid movements. The most remarkable Dance of Death was painted, in fresco, on the walls of the churchyard in the suburb of St. John at Basel, which was injured, in early times, by being washed over, and is now entirely destroyed. This piece has been ascribed to the celebrated Hans Holbein; but it has long since been proved that it existed 60 years before his birth. It was painted at Basel in the year 1431, by an unknown artist, in commemoration of the plague, which prevailed there at that time. It represented Death as summoning to the dance persons of all ranks, from the Pope and the emperor down to the beggar, and was explained by edifying rhymes. That piece contained about 60 figures as large as life. Besides being ascribed to Holbein, as was before stated, it has also been ascribed to a painter named Glauber, but without foundation. Holbein perhaps conceived, from this picture, the idea of his Dance of Death, the original drawings of which are at St. Petersburg. Very fine



## DANCE — DANCING

engravings of these are in the 'Œuvres de Jean Holbein, par Chrét. de Méchel' (Vol I, Basel 1780).

**Dance, St. Vitus.** See CHOREA.

**Dancing**, a form of exercise or amusement in which one or more persons make a series of graceful movements in measured steps in accord with music. Aristotle ranked dancing with poetry, and Pindar applies the name of "The Dancer" even to Apollo. Dancing corresponds to a universal primitive instinct in man, and is practised by the South Sea Islanders, the Forest Indians of Brazil, the Zulus, the negroes of central Africa, and the native Australians, exactly as it was in the earlier stages of every civilized modern race. Ferocious war-dances were practised by savage warriors, as the North American Indian braves, who brought on a frantic mechanical intoxication capable of carrying them to victory. The Zulu war-dance is a noble exercise for warriors, like the Pyrrhic dance of the ancient Spartans; and the dancing and spinning dervishes in the East, who work themselves into spasms of physical excitement, are still highly esteemed for devoutness and piety. The idea of magic always enters into savage dancing. Thus, the Mandan Indians dance the buffalo-dance to bring game when supplies of food are low. The rain doctors of central Africa dance mystic dances to bring rain; and the wives of the Gold Coast negroes dance a battle-dance to give their absent husbands courage in battle.

The art of dancing dates back to the early Egyptians, who ascribe that invention to their god, Thoth. Among the ancient Jews, Miriam danced to a sound of trumpets, itself an act of worship, and David danced in procession before the Ark of God. Religious processions went with song and dance to the temples; the Cretan chorus moving in measured pace sang hymns to the Greek god, Apollo, and one of the Muses (Terpsichore) was the special patroness of the art. The Phrygian Corybantes danced in honor of Cybele, and the festivals of Rhea Silvia at Rome were also accompanied with wild dances, while during the early festival of Mars the Salian priests sang and danced, beating their shields. The Spartans practised dancing as a gymnastic exercise and made it compulsory on all children from the age of five. The Romans in general considered it disgraceful for a free citizen to dance except in connection with religious rites, but willingly witnessed the performances of professional dancers like the Almé of modern Egypt, and the Bayadères, or Nautch girls, of India. The early Christians practised choral dances, which came into discredit with the love-feasts or Agapæ. A survival of religious dancing is still seen even within the pale of Christendom, where during the Corpus Christi octave a ballet is danced every evening by boys from 12 to 17 years of age, wearing plumed hats and in the dress of pages of Philip III.'s time.

The Puritan ancestors saw deadly sin in promiscuous dancing. Father Mariana tells us that the famous saraband worked more mischief than the plague. The fandango was hotly condemned by the clergy, but when danced before the Sacred College, who wished to see it before prohibiting it, so charmed the judges that they gave it their unanimous approval. Many of the

medieval dances were solemn and stately in character like the *danses basses*, which were danced to psalm tunes at the court of Charles IX. of France. It is said that the whole august Council of Trent danced at a ball given in 1502 to King Philip II. of Spain. The *Galliarde* and *volta* were introduced into France from Italy by Catharine de Medici. Dancing reached its height during the reign of Louis XIV., who was himself an enthusiastic dancer in the court ballets.

The minuet was a favorite in France for a century; and then came the quadrille or *contre-danse*, often connected erroneously with the English country-dance; the *Rossaise* was first introduced in 1760; the galop was introduced from Germany; the cotillon was fashionable under Charles X.; polka was first danced at the Odéon in 1840 by a dancing master from Prague; the polka tremblante or schottisch, was of Bohemian origin and was first brought out in Paris in 1844; the lancers was introduced by Laborde in 1861; and the waltz, originally Bavarian, and now modified from its original form, promises to retain its supremacy.

Characteristic of particular races or merely of classes of people are such forms of the dance as the Scotch reel, Highland fling, and strathspey, the Irish jig, the negro break-downs, sailors' hornpipe, step-dances, the can-can, morris dances, etc.

A ballet is a theatrical exhibition composed of dancing, posturing, and pantomimic action. The Roman pantomimes bore a strong resemblance to the modern *ballet d'action*. In an entertainment given to celebrate the victory of Actium, the "Trachiniae" of Sophocles, and an erotic interlude founded on the myth of Leda, were performed in dumb show, the dancers Pylades and Bathyllus taking the leading parts; and the whole wound up with a Pyrrhic war-dance. Some tradition of this form of entertainment, doubtless, suggested the courtly dances which became fashionable in the early days of the Renaissance. The first on record was that given by Bergonzio di Botta, at Tortona, to celebrate the marriage of the Duke of Milan in 1489. This was famous throughout the civilized world. From that time great events, such as royal marriages and births, were celebrated by grand productions of ballet on which enormous sums of money were lavished. These ballets were frequently historical in subject, treating of the siege of Troy, the conquests of Alexander, and similar events. There were also mythological, poetical, moral, and fantastic ballets, on such subjects as the Judgment of Paris, the Seasons, Truth, the Diversions of the Carnival, etc. All these were in five acts, each of which consisted of 3, 6, 9, or 12 entries, and in all of them singing and recitation mingled with the dancing.

Catharine de Medici introduced the ballet into France, and encouraged dances by females that would now be deemed highly improper, to distract the attention of her son, Henry III., from state affairs. Henry IV. was a great supporter of the ballet, no fewer than 80 grand entertainments being given by him between 1580 and 1610. Louis XIII. and Louis XIV. carried their love of ballet to an extreme length, and themselves danced publicly. In 1661 the latter founded an Academy of the Dance, with Quinault as director, and Lully as composer. It was not until 1681 that female dancers appeared in

## DANCING DISEASE — DANDIE DINMONT

public, the first being four ladies, who danced "La Triomphe de l'Amour." In the early part of the 18th century the names of professional dancers began to appear, two of the most famous being Mlles. Salle and Camargo, immortalized by Voltaire. The great male dancer of this time was Dupré, the predecessor of the universally known Gaetano Vestris.

In 1697 De la Motte introduced more changes into the ballet, chiefly in the direction of more interesting subjects, and about the same time comic ballets were invented by Danchet; but no important alterations were made till the advent of Jean Georges Noverre in 1749. The dancers wore masks, huge wigs, and headdresses, and hoops. The mask finally disappeared in 1773. Hitherto the form of the ballet had remained practically unchanged, each act being performed by different dancers, and generally in different styles of dancing. Noverre invented the *ballet d'action*, and revived the art of pantomime. Dancing now had dramatic meaning, and the most intricate plots were represented by pantomime alone. The principles of Noverre were carried to great perfection by Vincenzo Galleotti in Copenhagen, and by his successor, Bournonville. Under the Directory a form of grand ballet was revived, in which patriotic songs were a feature.

The history of the ballet since Noverre's time is a history of dancers rather than of dancing. In England, this class of entertainment was never more than an exotic, and has practically no history. The word *balette* is first used in English by Dryden (1667), and the earliest attempt at a descriptive ballet seems to have been 'The Tavern Bilkers,' played at Drury Lane in 1702. Within the last few years an important revival of the ballet has taken place in Italy, where the famous "Excelsior," by the Chevalier Luigi Manzotti, Messalina, Amor, etc., have furnished magnificent examples of the *ballet d'action*.

Skirt-dancing, so called on account of the voluminous skirts made of sheer or flimsy material, which are worn by the dancers and play so important a part in their dances, has become a science and a popular attraction on the stage. The dancers, by the clever manipulation of their draperies and assisted by light effects, assume such forms as flowers; the rose, calla lily, pansies, pinks; butterflies of different colors, and flags of various nationalities; all to the accompaniment of music. Among the most noted skirt dancers were Amelia Glover, Loie Fuller, the inventor of the serpentine dance, Papinta, and Anna Held.

DANIEL FROHMAN.

**Dancing Disease**, an epidemic nervous disorder, apparently allied to hysteria and chorea, occasionally prevalent in Germany and Italy during the Middle Ages. In the last-mentioned country the disease was ascribed to the bite of a spider called the tarantula; but as scarcely any of those affected with it had any consciousness of being bitten by a spider or any other insect, and as it has been in every instance chiefly propagated by physical contagion, like chorea, there is every reason to conclude that it had a like origin. In 1734, during the celebration of the festival of St. John, at Aix-la-Chapelle, the streets became crowded with men and women, of all ranks and ages, who commenced dancing in a wild and frantic man-

ner, many losing entire control over themselves, and continuing to dance until dropping down from fatigue, and some, in a moment of frenzy, dashing out their brains against walls. The mania spread to Cologne, Metz, and Strasburg, and gave rise to much imposture, profligacy, and disorder. At the beginning of the 17th century the epidemic began to decline; and is only known now as a nervous affection in individual cases.

**Dancing Faun**, a frolicsome sylvan creature, half-human, half-goat, corresponding to the Greek Satyr, only gayer and less hideous than his woodland brother; often used in ancient comedy as the very embodiment of humor and mischief. Poets, painters, and sculptors of every age have loved to depict the faun in the madness of dancing.

Rough Satyrs danced and Fauns with cloven heel  
From the glad sound would not be absent long.  
Milton, *Lycidas*, l. 34.

**Dancla, Jean Baptiste Charles**, zhôn báp-têst shârl dân-klâ, French musical composer and violinist: b. Bagnères de Bigorre 19 Dec. 1818. He was a pupil at the Conservatory of Paris, where he took the first prize for the violin in 1833, at the age of 15, becoming professor there in 1857. He displayed remarkable fecundity as a composer, among his works being: a 'Method of the Violin,' studies, sonatas, solos, fantasies, and airs for that instrument; symphonies, trios, and quartettes for stringed instruments; 'Christopher Columbus,' a dramatic scene for an orchestra; a volume of 'Notes and Souvenirs' (1893).

**Dancourt**, dân-koor, Florent Carton, French actor and playwright: b. Fontainebleau 1 Nov. 1661; d. Courcelles-le-Roi, France, 6 Dec. 1725. Although he personated the first characters in high comedy, he succeeded best as an author in low comedy. He displayed much ingenuity and wit in introducing upon the stage amusing subjects of real occurrence in his time. Louis XIV. was very fond of humorous pieces, and Dancourt often used to read his productions to the king before they were played. Among his dramas are: 'Le Chevalier à la Mode' (1687); 'Les bourgeois de qualité' (1700); 'Les trois cousins' (1700).

**Dandelion**, the common and well-known plant, *Taraxacum officinale*, belonging to the chicory family. It yields a milky juice, which in the form of extract is used medicinally as a diuretic and alterative. It contains a bitter crystalline principle called taraxacin. Its root has been used to adulterate coffee in a similar way to chicory, and is used to adulterate chicory itself. The blanched leaves are eaten as a salad. In America it is a common article of food in the spring of the year, boiled and eaten as "greens." It has a naked, hollow stalk, with a single bright yellow flower. The seed is furnished with a fine white pappus, by means of which it is carried far and wide by the wind. The leaves are lanceolate and sinuous, rising from a taproot in the form of a rosette. The plant is probably native in certain parts of America, but is found as a weed in all parts of the civilized world.

**Dandie Dinmont**, a small terrier, 8 to 11 inches high at the shoulder, and bred chiefly in Scotland as a pet. It is generally bluish-gray, or tan in color; its coat is soft and silky; and its eyes are a soft hazel. It is a gentle and affec-



tionate little creature, and has become celebrated in literature through the writings of Sir Walter Scott, one of whose favorite dogs was among the earliest of this breed.

**Dandolo, Andrea**, än-drä'ä dän'dō-lō, Doge of Venice and Italian historian: b. about 1310; d. September 1354; and made doge in 1343. He carried on a war against the Turks with various success, and greatly extended Venetian commerce by opening a trading connection with Egypt. The jealousy entertained by the Genoese of this new trade produced a war between the two states, which gave rise to a correspondence between the doge and Petrarch, who exhorted him to peace. To Andrea Dandolo is ascribed the compilation of the sixth book of Venetian statutes; but he is most distinguished for his 'Chronicle of Venice,' written in Latin, and comprehending the history of the republic from its commencement to 1342. It is praised for its impartiality, and for its judicious use of authentic documents, and was first published by Muratori in his collection of original Italian historians.

**Dandolo, Enrico**, ən-rē'kō, Doge of Venice: b. Venice about 1108; d. Constantinople 14 June 1205. He was chosen to office in 1192, at the advanced age of 84. He had a defect of sight approaching nearly to blindness; but neither that circumstance nor his age impaired the vigor of his administration, the events of his government being among the principal causes of the Venetian greatness. On the formation of the league for the fourth Crusade, under Baldwin, Earl of Flanders, Dandolo induced the senate to join in it, and by his policy the first hostilities of the armament were directed against Zara, which had revolted from Venice. On the storming of Constantinople, the aged doge, it is said, was the first who mounted the walls. On the Crusaders proceeding to the election of a new emperor of the city Dandolo was first nominated; but in consequence of his age, and the incompatible character of doge, he declined, and the choice ultimately fell on Baldwin. In the sharing of the imperial dominions Venice obtained a full moiety, and Dandolo was solemnly invested with the title of Despot of Romania.

**Dandruff**, a condition of scaliness in the head, attended with desquamation or scaling of the superficial layers of epidermis. It may simply indicate a dry and unhealthy skin, or it may be the result of several distinct skin diseases, chief of which is pityriasis. There is usually a slight amount of itching, and on scratching the head large quantities of minute scales are detached and fall on the clothing. Dandruff also occurs from seborrhœa, in which case it is due more to a mild inflammation of the fat follicles of the skin. The sebaceous matter from the glands dries and forms scales. One of the general results arising from dandruff is a gradual loss of hair. The treatment consists in better hygiene of the head, shampoos, and careful stimulation by appropriate tonics. Many of the so-called hair tonics are valueless. Vigorous rubbing of the scalp, with periodical shampooing, is one of the best means of combating this condition, but medical advice should always be sought as to the exact cause of the dandruff. See HAIR.

**Dane, Nathan**, American jurist: b. Ipswich, Mass., 27 Dec. 1752; d. Beverly 15 Feb.

1835. He was graduated from Harvard in 1778, studied law in Salem, Mass., and began practicing in the adjoining town of Beverly in 1782, where he resided until his death. He was among the most eminent lawyers in New England, and was at various times a member of the State legislature. In 1812 he was chosen an elector of President of the United States; in 1814 he was a member of the Hartford convention; and in 1820 he was chosen a member of the convention for revising the constitution of Massachusetts. While he was a delegate from Massachusetts to the Continental Congress in 1786, the best method of providing for the government of the vast territory owned by the Confederacy north and west of the Ohio River came into consideration. It was determined to do this by an ordinance which should establish with much detail not only the foundation of that government, but the leading principles which should prevail in the systems of law and public policy to be in force there. The drafting of this instrument was intrusted to Dane; and it was adopted by Congress without a single alteration, 13 July 1787. The clause in it which has been the subject of most frequent and emphatic remark is that which provides "that there shall be neither slavery nor involuntary servitude in the said territory." The name of the "Northwest Territory" was given to it; and it comprehended all the territory at that time belonging to the Confederacy northwest of the Ohio. Not long before his death, he stated in conversation that not until this ordinance was on the eve of enactment did the thought occur to him of inserting in it this clause respecting slavery. He incorporated in this ordinance a prohibition against all laws impairing the obligation of contracts, which the convention that formed the Constitution of the United States, a few months afterward, extended to all the States of the Union, by making it a part of that Constitution. His 'Abridgment and Digest of American Law' appeared 1823-9. In 1829 he imparted new vigor and life to the law school in Harvard University, in Cambridge, by giving \$10,000 (adding \$5,000 more in 1831) for the foundation of the Dane professorship of law.

**Dane, The Great**, one of the breed of large close-haired dogs, originating in Denmark. It is very powerful and intelligent, and is esteemed by sportsmen as a perfect boarhound. These huge dogs resemble the type of the ancient war-dogs. The minimum height of a typical Great Dane is 30 inches and the weight 100 pounds. The body is compact and long; the ears small; eyes small and deep-set. The colors vary, running through gray, mouse-color, white, fawn, red, etc., and sometimes present patches or stripes.

**Danebrog**, dän'ē brög, the Danish national flag (*brog* simply meaning cloth), which was carried at the head of the army, like the oriflamme of France. It is red with a white cross in the centre, and, as the legend has it, fell from heaven, as an omen of victory, when the pious Danes under Waldemar II. were besieging the pagan town of Reval. In memory of this auspicious event the king founded the order of the Danebrog, which fell into abeyance, however, at a later period. In 1671, under Christian V., and again under Frederick VI., it was revived. It may be conferred upon all ranks, and may be awarded for military or civil services. The dec-

oration consists of a white enameled gold cross, suspended by a white ribbon with a red border.

**Danegeld**, dān'gēlt, or **Danegelt** (A.-S. *Dene*, Danes; *gild*, *geld*, payment), an ancient annual tax of the Anglo-Saxons, to maintain forces to resist the Danes. It was first paid in 991, when Ethelred purchased the retreat of the invaders, which had reached as far as Maldon. The tax was continued until the time of Stephen, as one of the rights of the crown.

**Danelagh**, dān'lā, the ancient name of a strip of territory extending along the east coast of England from the Thames to the Tweed, ceded by Alfred the Great to Guthrun, king of the Danes, after the battle of Ethandune. This name (Danelagh or Dane-law) it retained till the Norman conquest, and its inhabitants were governed by a modification of Danish law and not by English law. King Canute, to prevent any changes in the laws, had them gathered together and taught to the people.

**Danenhower**, dā'nēn-how-ēr, **John Wilson**, American Arctic explorer: b. Chicago, Ill., 30 Sept. 1849; d. Annapolis, Md., 20 April 1887. He was graduated at the United States Naval Academy in 1870, and took part in a surveying expedition to the northern Pacific on the Portsmouth. He joined the Jeannette expedition, which started from Havre, France, went to San Francisco, and thence sailed, 8 July 1879, for the Arctic Ocean, via Bering Strait. The vessel was lost in the ice and the crew after dragging their boats over the frozen deep for 95 days, reached the open sea. A terrible storm separated the boats and none ever was heard of except the one in which Lieut. Danenhower had embarked. It reached Lena Delta, 17 Sept. 1881, and he arrived in the United States in June 1882. He wrote 'The Narrative of the Jeannette.'

**Daneo**, Giovanni, jō-vān'nē dā-nā'ō, Italian dramatist: b. St. Rémy, Piedmont, 16 May 1824. He wrote some dramas of very considerable merit: 'Suleika'; 'Elisa di Montalpino'; also novels: 'Memoirs of a Gentleman' and 'The Castle of Bardespina.' His poetical works consist of two volumes of miscellaneous 'Poems' and 'Verses,' with 'Gotama' and 'Rafaëlio Sanzio Temosforo.'

**Danes**, the natives of Denmark. The first mention of them was early in the 6th century, when they were living on the west coast of the Cimbrian Peninsula, whither they had gone from Scandinavia. Their written literature dates from the 13th century, but ancient runic inscriptions in the old Danish language have been found which date from the Viking age (700-1050). The folk-lore and legends that were transmitted from one generation to another, before printing was invented, are valuable contributions to the literature of the present. There are three separate dialects spoken which are represented by the people of Sweden, Zealand, and Jutland. The Zealand dialect became the literary form about the time of the Reformation, from which period modern Danish dates.

**Danes Island**, a place made noted by Andrée, the Arctic explorer, who, on 11 July 1897, started from this island on his fatal polar expedition. It is a small island off the coast of the Spitzbergen group and on the northwest.

**Danewerk**, dā'nē-vērk (Danes' work), an ancient wall from 30 to 40 feet high and of an

equal thickness, constructed of earth, stone, and wood, about the middle of the 10th century, seemingly as a protection against the Saxons. It extended along the southern frontier of Schleswig for a distance of nearly 10 miles, and being defended by a series of forts the Danes relied upon it to check the approach of the German troops during the Schleswig-Holstein war of 1864. It was soon discovered that their army was too weak for the defense of so extensive a line, and the position was abandoned. The wall was soon after leveled to the ground.

**Danforth**, Moseley Isaac, American engraver: b. Hartford, Conn., 1800; d. 1862. He assisted in the founding of the National Academy of Design, spent 10 years in London, in which period he made some noted drawings of the Elgin Marbles, and returning to the United States devoted his attention mainly to the engraving of bank notes.

**Danhauser**, Joseph, yō'sēf dān'how-zēr, Austrian painter: b. Vienna 18 Aug. 1805; d. 4 May 1845. He turned his attention at first to historical painting, and living for some time at Venice, fell under the influence of the works of Titian and Paolo Veronese, and followed religious painting for a while, later becoming a genre painter, which better suited his talent. Among his historical pictures is 'Etienne the Fortunate Offering the Crown of Hungary to the Virgin' (1832). An altar piece in the cathedral at Erlau, representing the martyrdom of St. John, and an 'Abraham Driving Away Hagar and Ishmael' are noted among his religious pictures. He is perhaps best known by his humorous scenes depicting the manners and customs of Austrian life. Of these there are several in the Imperial Museum at Vienna. Many of his works have been popularized by engraving, such as: 'Cured without knowing it'; 'The Oculist'; 'The Prodigal'; 'Reading the Will'; 'Soup at the Convent'; 'Wine, Women, and Song'; 'Judge and Lawyer'; and 'The Evening Festival,' his last work.

**Daniel**, Hebrew prophet. He was a contemporary of Ezekiel, and was born of a distinguished Hebrew family. In his youth 600 B.C. he was carried captive to Babylon, and educated in the Babylonish court for the service of King Nebuchadnezzar. After three years he entered into the service of this monarch and discharged his employments with much credit to himself and without violating his conscience. A decree of the king which he could not conscientiously obey occasioned his being thrown into the lions' den. Preserved by a miraculous providence he was subsequently elevated to the office of governor and prime minister in the court of the Persian king Darius. Cyrus finally gave him permission to return with his people to Palestine. He ranks with what are called the "greater," in contradistinction to the 12 "minor" prophets. See DANIEL, BOOK OF.

**Daniel**, Anthony, French Jesuit missionary in North America: b. Dieppe 1601; d. 4 July 1648. In company with the Sieur de Champlain he came to Quebec in 1633 and was soon after transferred to the mission among the Huron Indians. He was shot during an attack upon the town of Saint Joseph by a band of hostile Iroquois.

**Daniel, John Moncure**, American journalist: b. Virginia 1825; d. 1865. He became a member of the staff of the Richmond *Examiner* in which capacity his free speech obliged him to engage in several duels. He was appointed minister to Sardinia in 1853, but his indiscreet action in several matters seriously impaired his influence as a diplomatist. During the Civil War he served in the Confederate army for a time, but resuming his editorship of the *Examiner* attacked in its columns the president and treasurer of the Confederacy, and in consequence was obliged to fight a duel with the latter.

**Daniel, John Warwick**, American politician: b. Lynchburg, Va., 5 Sept. 1842. He served in the Confederate army during the Civil War; subsequently studied law and entered upon the practice of his profession. He was a member of both Houses of the Virginia legislature 1866-72 and 1875-81; and was defeated for governor of his State in 1881. He was a member of Congress 1885-7; entered the national Senate in the year last named and was re-elected at the expiration of his term. He has published 'Attachments Under the Code of Virginia'; 'Negotiable Instruments,' etc.

**Daniel, Samuel**, English historian and poet: b. Taunton, England, 1562; d. Beckington, Somerset, 14 Oct. 1619. As an historical poet Lucan seems to have been his pattern. He bestowed much labor on the poem which describes, in eight books, the civil wars between the houses of York and Lancaster, 'History of the Civil Wars between the Houses of York and Lancaster.' Daniel contributed much to the improvement of the poetical diction of England. His stanzas, formed with a careful attention to the Italian octave, have more dignity and euphony than most verses of this sort in English literature in the first half of the 17th century. He is not wanting in rhetorical beauty and force. He was also the author of some poetical epistles, pastorals, 57 sonnets, and a few tragedies. The first seem to have excited much attention. During the reign of Queen Elizabeth he wrote a sketch of the history of England till the time of Edward III.—a work learned and clear, without ostentation, and containing useful and acute views.

**Daniel, Book of**, an important canonical book of the Old Testament. It stands in our Bible, as well as in the LXX. and Vulgate, immediately after Ezekiel, while in the Hebrew canon it is not included in the collection of the Prophets, but appears among the miscellaneous 'Writings.' Delitzsch points out that the book nowhere claims to be written by Daniel, and that its position in the canon shows that it is not properly a prophetic book, but an apocalypse. It is written partly in Hebrew, partly in Aramaic, but forms a coherent whole, which is now divided into 12 chapters, the first half consisting of narrative, the second half of predictions. These predictions are not prophetic speeches like those of the other prophetic scriptures, rebuking the sins of contemporaries, foretelling judgment on the impenitent, and promising Messianic salvation to the repentant and believing; they are minutely detailed apocalyptic visions embracing the history of four successive world-empires—the Chaldaean, the Median, the Persian, and the Greco-Macedonian—culminating in the establishment of the eternal kingdom of the saints of

the Most High. Objections to the Danielic authorship of the book were made by the Neoplatonist Porphyry as early as the 3rd century A.D., but first found support in the critical investigations of Bertholdt (1806-8), followed by those of Bleek, De Wette, Langerke, Ewald, Lücke, and others. These investigations have led to the view that the book was not written till the time of the religious persecution of Antiochus Epiphanes, about 168-5 B.C. But the book is certainly of great importance, and "has exercised," says Schürer, "a profound influence upon the form of the Messianic idea. . . . In this book (xii. 2) the hope in a resurrection of the body is for the first time plainly and decidedly expressed. The Messianic hope is here the hope of a glorious future for the nation, but with the double modification that the future kingdom of Israel is conceived of as a universal kingdom and that all the saints who have died will share in it." According to Delitzsch, our Lord's testimony in Matt. xxiv. 15 proves "that Dan. ix. 26, et seq., is a prophecy of the desecration of the temple in the Roman war, not that it is a prophecy then fulfilled for the first time." See Hilgenfeld, 'Die Jüdische Apokalyphtik' (1857); and the special commentaries by Hitzig (1850), Auberlen (3d ed. 1874), Hilgenfeld (1863), Caspari (1869), Pusey (1864), Desprez (1879), and Robinson (1882).

**Daniel Deronda**, George Eliot's last novel, considered by some critics her greatest work. Deronda was brought up in ignorance of his Jewish parentage, but ultimately cast in his lot with his own people. The influence of Deronda remolds the character of the heroine, Gwendolen Harleth, who is unhappily married to Grandcourt. In 'Daniel Deronda' George Eliot had three objects in view: (1) To show the influence of heredity; (2) to show that ideals and sentiments lie at the basis of religion; (3) to contrast a social life founded on tradition (that of the Jews) with mere individualism. The novel was first published as a whole in 1877.

**Daniell, John Frederic**, English scientist: b. London 12 March 1790; d. 13 March 1845. He was elected a Fellow of the Royal Society in 1814, and devoted himself to chemistry and meteorology. In 1823 he published his 'Meteorological Essays'; and in 1831 was appointed professor of chemistry in King's College, London; and in 1839 published his 'Introduction to Chemical Philosophy.' In 1843 he received the degree of D.C.L. from the University of Oxford, and obtained all the three medals in the gift of the Royal Society. He invented a hygrometer (1820), and a new pyrometer (1830), as well as the electric battery known by his name; and he wrote many valuable papers on chemistry, especially on voltaic combinations and electrolysis.

**Daniell, Samuel**, English artist and traveler: b. London 1777; d. Ceylon 1811. He was a brother of William Daniell (q.v.). He spent three years at the Cape of Good Hope, and afterward proceeded to the interior of Africa, making sketches of the scenery and people, which he brought home with him to England in 1804, when they were published, with an account of the animals of southern Africa. He afterward went to the island of Ceylon, and during a residence of six years collected a large amount of similar materials, one volume of which was

published, with a description of that country and its inhabitants, in 1808.

**Daniell, Thomas**, English landscape painter and engraver: b. 1749; d. London 1840. In company with his nephew, William Daniell (q.v.), he made an extraordinary journey through India, for the purpose of preparing sketches and illustrations of the scenery, which were afterward published with the title 'Oriental Scenery' (1808). He was originally a heraldry painter, and became Fellow of the Royal, Asiatic, and Antiquarian societies. He published also 'Views in Egypt'; 'Hindu Excavations at Ellora'; 'Picturesque Voyage to China by Way of India' (1817).

**Daniell, William**, English painter and engraver: b. 1769; d. 1837. He set out at the age of 14, in company with his uncle, Thomas Daniell (q.v.), upon an artistic exploration of the peninsula of Hindustan. They began their journey at Cape Comorin, and sketched almost every thing beautiful or interesting in the country between that point and Serinagur, in the Himalaya Mountains. They were occupied 10 years in this undertaking. Of their immense number of sketches, they selected and published a portion in a great work entitled 'Oriental Scenery' (1808). William also published 'A Picturesque Voyage to India'; 'Zoography'; 'Animated Nature', etc., and from 1814 to 1825 was engaged in making sketches for 'A Voyage round Great Britain.'

**Daniels, Cora Linn**, American author: b. Lowell, Mass., 17 March 1852; married Joseph H. Daniels 1874. She has written much for the press and has published in book form: 'Sardia' (1892); 'As it is To Be: Psychical Philosophy' (1892-1900); 'The Nurse'; 'Omar Khayyam'; 'The Bronze Buddha' (1899); 'Encyclopedia of Superstitions of the World' (1901).

**Daniels, Frank**, American actor: b. Dayton, Ohio, 1860. He was educated in Boston, Mass., and made his appearance on the stage there in 1883. His first success was in 'A Rag Baby' and he has since acted in many farces and light operas.

**Daniels, William Haven**, American prose writer: b. Franklin, Mass., 18 May 1836. He was for some years in the Methodist ministry. He has published: 'That Boy: Who Shall Have Him?' (1878); 'The Temperance Reform and Its Great Reformers' (1878); 'Moody, His Words, Work, and Workers' (1879); 'Illustrated History of Methodism in the United States' (1880); 'A Short History of the People Called Methodist' (1882).

**Danish East India Company.** See EAST INDIA COMPANIES.

**Danish Language and Literature.** See DENMARK.

**Danish West Indies.** See WEST INDIES, DANISH.

**Danites**, dān'its, a former secret society of the Mormon Church, for militant action against its enemies. It was organized by Joseph Smith at Kirtland, Ohio, 30 March 1836, by a "covenant" to avenge any further expulsion of the Missouri Mormons by mobs; on the basis of a "revelation" of 6 Aug. 1833, justifying any Mormon in "rewarding thine enemy according to his works." The first name chosen was Daughters of Zion, from Micah iv. 13; this not

seeming graphic, it was changed to Destroying Angels, or Flying Angels, the former used for many years; then the Big Fan (Jer. xv. 7 or Luke iii. 17); then Brothers of Gideon; finally Sons of Dan, turned by outsiders into Danites, from Gen. xlix. 17. A constitution was adopted, giving the executive power to the president of the Church and his counselors, and the legislative power to the same, with the generals and colonels of the society; this legislature to have power to "administer punishments to the guilty in accordance with the offense." The oath taken by the members was to obey the Prophet and First Presidency "in all things, the same as the supreme God"; to "stand by my brethren," and "uphold the presidency, right or wrong"; and invoking terrible punishments for revealing the secrets of the society. The Mormons have usually denied that the society existed, or if so that it was countenanced by the Church; and Smith's Nauvoo council denied its existence there. Brigham Young, however, boasted of its existence in Salt Lake City. Its actions, from the nature of the case, can only be inferred. It is usually credited with all the deeds of blood charged against the Mormons, including the Mountain Meadows massacre (q.v.). The name was attached by the Douglas Democrats to the administration (Buchanan) Democrats in the Lincoln-Douglas senatorial Illinois campaign of 1858, as an insinuation that they were Buchanan's tools in upholding the Utah rebellion.

**Dannat, William T.**, American figure painter: b. New York 1853. He was a pupil of the Royal Academy, Munich, and of Munkacsy in Paris, and took the medal of the third class in Paris 1883. Among his works are: 'Bavarian Peasant' (1878); 'Aragonese Contrabandist' (1883); 'Castanet Dance; A Quartette' (1884).

**Dannecker, Johann Heinrich**, yō'hān hīn'-rīn dān'nēk-ēr, German sculptor: b. Waldenbach, near Stuttgart, 15 Oct. 1758; d. Stuttgart 8 Dec. 1841. At the Karlschule he devoted himself so successfully to sculpture that a statue of Milo of Crotona, executed in his 17th year, excited great admiration. On leaving he was appointed court sculptor, and three years after visited Paris and Rome. In the latter city he executed a Ceres and Bacchus, which procured him admission into the academies of Bologna and Milan. In 1790 he returned to Würtemberg, and became professor of the fine arts at Stuttgart. From this period he continued his professional labors with most brilliant success, and was patronized by the most distinguished personages in Germany. His acknowledged masterpiece is a statue of Christ, which occupied him during eight years, and the prototype of which is said to have been suggested to him in a dream. His 'Ariadne seated on the Panther' is a splendid work, and in the opinion of some critics is superior as a work of art to his 'Christ.' As a sculptor he occupies an intermediate place between Canova and Thorwaldsen, having blended in the happiest manner the spirited conception of the former with great anatomical skill, careful execution, and nice appreciation of nature. See Radcliffe, 'Schools and Masters of Sculpture' (1894).

**Dannemora**, dān-ne-mō'ra, N. Y., a village in Clinton County; on the Chateaugay Railroad; 12 miles west of Plattsburg. Here is located one of the State prisons called Clinton State

Frison. The iron ore found in the vicinity is of an excellent quality. Pop. 4,213.

**Dannemora**, dän-nē-moo'rā, Sweden, a straggling village, on a lake of the same name, 24 miles northeast of Upsala, in the district of Upsala. It is celebrated for its iron mines, the second richest in Sweden, which have been worked uninterruptedly for upward of three centuries, and produce the finest iron in the world. The mine has been sunk more than 100 fathoms, and as part of the workings runs under the lake, great trouble is sometimes experienced in keeping out the water. The total quantity of ore raised is about 70,000 tons per annum. It consists of 86 to 90 per cent magnetic oxide of iron, 7 to 12 per cent silica, and traces of manganese, lime, magnesia, and alumina, the earthy matters being in the proportion to form a fusible slag without further addition. It is almost free from sulphur and phosphorus, and as the charcoal fuel employed in smelting is also free from these impurities, the Dannemora iron enjoys the highest reputation, and is in great demand for conversion into steel.

**Dannreuther**, dän'roi-tēr, Edward, English pianist and conductor: b. Strasburg, Germany, 4 Nov. 1844. He was educated at Cincinnati, Ohio, studied music at Leipsic under Moscheles, and in 1863 went to London where he afterward settled and lectured on Wagner, Bach, Beethoven, etc. He conducted the first Wagner concerts in London 1873-4, and has published: 'Musical Ornamentation'; 'Richard Wagner: His Tendencies and Theories'; 'The Music of the Future'; 'On Conducting.'

**D'Annunzio**, Gabriele. See ANNUNZIO GABRIELE D'.

**Dantan, Antoine Laurent**, än-twän lö-röñ dän-tän, called Dantan the Elder, French sculptor: b. Saint Cloud 9 Dec. 1798; d. there 31 May 1878. He was a pupil of Bosio, taking the second grand prize of Rome for sculpture in 1823 and the first prize in 1828, the latter for a 'Death of Hercules.' Yielding himself, at first, entirely to the influence of the antique in his art, he afterward found a more original style. He obtained the decoration of the Legion of Honor in 1843, and secured a medal of the third class at the Exposition in 1855. Among his works are: 'Young Bather and Dog' (1835), which took a medal of the first class 1833; 'Drunkenness of Silenus' (1836); a bronze 'Young Girl and Tambourine' (1838); 'Statue of Louis Joseph de Bourbon'; 'Statue of the Maréchal de Villars'; 'Bust of the Dauphin of France.' A monumental 'Juvenal des Ursins' was ordered for the Hotel de Ville in Paris 1838; and 'The Angel Raphael' for the Madeleine 1839. 'Duquesne' was made for Dieppe in 1844, and a 'Saint Christopher' for the church of La Villette in 1846. He was the author of many statues decorating the monuments of Paris, the churches of Saint Gervais, Sainte Clotilde, Saint Laurent, the Tower of Saint Jacques, the belfry of Saint Germain l'Auxerrois, and the new Louvre, besides busts for the museum at Versailles, the senate, and the Comédie Française.

**Dantan, Jean Pierre**, zhön pä-är (called 'DANTAN THE YOUNGER'), French sculptor: b. Paris 26 Dec. 1800; d. Baden 6 Sept. 1869. He was a brother of A. L. Dantan (q.v.). He

achieved great reputation for his diverting caricatures of prominent men, such as: Paganini, Rossini, Victor Hugo, Frederic Soutie, Balzac, Alexander Dumas, Frederic Le Maitre, and of himself, which were exhibited at the Dantan Museum in Paris, but his popularity as a caricaturist injured to some extent his fame as a serious artist. Among his works are statues of Boieldieu, at Rouen; Philibert Delorme, at the Louvre; and busts of Adelaide Kemble, Rose Cheri, Canrobert, Jean Bart, Pleyel, Rossini, Thalberg, Duke of Wellington, and Lord Brougham.

**Dantan, Joseph Édouard**, zhō-zéf ā-doo-är, French painter: b. Paris 26 Aug. 1848; d. Villerville 1897. He was a son of J. P. Dantan (q.v.). He was a pupil of Pils, but soon abandoned historical and religious for genre painting. Among his works are: 'The Holy Trinity'; 'An Episode of the Destruction of Pompeii' (1869); 'A Monk Carving a Christ in Wood'; 'Hercules at the feet of Omphale' (1874); 'The Nymph Salmacis and the Young Hermaphrodite' (1876); 'Vocation of the Apostles Peter and Andrew' (1877); 'The Corner of a Studio' (1880); in the Luxembourg; 'Breakfast of the Model' (1881); 'Interior at Villerville' (1883); 'The Studios' (1884); 'The Widower' (1885); 'Modeling from Nature' (1887).

**Dante** (originally DURANTE) **Alighieri**, dän'tā a'lē-gē-ä'rē, Italian poet: b. Florence May 1265; d. Ravenna, Italy, 14 Sept. 1321. He was of a family belonging to the lower nobility, and of mixed descent, the Aldighieri, or Alighieri, being originally Teutonic. He lost his father in early life, but his mother watched carefully over his education, which was confided to the eminent philosopher and statesman, Brunetto Latini. He is said to have studied at Bologna, Padua, Naples, and even Paris and Oxford, but we have no means of confirming the statement in any measure. What is tolerably certain is that he had mastered the learning of that age. He was a musician and painter, a theologian and linguist of no mean order. Many of his biographers state that it was in 1274, when nine years of age, that he saw for the first time, and ever afterward devotedly loved, Beatrice Portinari. Others affirm that that event took place shortly before her death, in 1290, three years after she had married a noble Florentine, Simone Bardi. His love for her awakened in him a new life; all the powers of his soul were to be henceforth devoted to immortalize her, and we can watch the struggles of his spirit in that record he has left us of his early years, the 'Vita Nuova.' About the period when Dante reached the age of manhood the Guefs (the Papal or Church party) were predominant in Florence, whence they had, aided by the Pope and Charles, king of Naples, driven the Ghibellines (the imperial or state party). At Arezzo, on the other hand, the Ghibellines had succeeded in exiling the Guefs, who implored the assistance of their Florentine friends. A war was declared between the two cities, which was terminated in June 1289 by the battle of Campaldino, in which the Ghibellines were defeated. Dante was there fighting bravely, and contributed not a little to the victory of the Guefs. In 1291 he married Gemma dei Donati, a daughter of one of the most powerful families of the state, and which belonged to the Guelf



faction. By this lady he had seven children, the youngest, Beatrice, being born about 1301. In 1293 a revolution broke out in the city, headed by Giano della Bella, whereby the priors of the trades took the power into their own hands, and made nobility a disqualification for holding office. The following year, however, Giano della Bella was deprived of power, and the nobles disagreeing among themselves, and splitting into two factions, the Bianchi and the Neri (the White and the Black), the streets of Florence were continually the scenes of sanguinary fights. In order to check the excesses of the greater nobles, a number of the lesser nobility, Dante among them, threw in their lot with the citizens' party. In order to render himself eligible for office Dante had his name inscribed in the books of the physicians and apothecaries, and in June 1300 was nominated a prior of the trades, one of the highest offices in the state. Although leagued by marriage to the Guelph side, Dante was no rampant partisan, and on one occasion, when roused by some fresh act of atrocity, he proposed and carried a law to the effect that the heads of the Bianchi and Neri parties should be temporarily banished. It appears that the Bianchi and Neri were originally Guelphs, but the latter were the extreme Papal party, and the former leaned toward a reconciliation with the Ghibellines. Dante's sympathies were with the Bianchi, and on the too hasty return of one of the exiles, Guido Cavalcanti, a friend of the poet's, and one of the Bianchi, Dante was charged with undue partiality in permitting him to remain in the city. The Neri wrote to the Pope that the Bianchi were making common cause with the Ghibellines, and Boniface VIII. sent Charles of Naples to occupy the town, and keep down the turbulent spirit of the Florentines. The Neri were allowed, however, to commit the greatest excesses unchecked by Charles: many of their rivals were slain in the open street, and their houses burned to the ground; among others that of Dante, who had been sent to Rome by his party to try to influence the Pope in their behalf. Taking advantage of his absence, his enemies obtained a decree of banishment against him, together with the heads of his party, and he was further condemned to pay a fine of 8,000 florins, or have his property confiscated (January 1302). Two months later a second sentence was launched against him and several of his friends: they were condemned to be burned alive for malversation, peculation, and usury. The fine he refused to pay, as it would imply a confession of guilt.

From this time forth the life of the poet becomes semi-mythical. We find some traces of him first at Arezzo, then at Sienna, then at Verona. He himself says, "Through almost all parts where this language (the Italian) is spoken, a wanderer, well nigh a beggar, I have traveled, showing against my will the wounds of fortune." His sympathies now lay entirely with the Ghibelline party. The expedition of the emperor, Henry VII., into Italy (1310) roused the hopes of Dante to the highest pitch. He wrote the emperor that famous letter advising him first of all to crush the hydra, Florence, as being the cause of all the misfortunes of Italy. Henry, however, spent his time in foolish inactivity till his death in 1313. Shortly after this event Dante is said to have visited Paris; but according to Balbo he spent the year 1313-14

in Pisa and Lucca, and then took refuge with Can Grande della Scala at Verona, where he remained till 1318. In 1316 Florence sent forth a decree permitting the exiles to return on conditions of fine and penance, which Dante indignantly refused. In 1320 we find him at Ravenna staying with his friend Guido Novello da Polenta. In the following year, on his return from an embassy to Venice, his wanderings and sufferings were ended by death. He was buried in the Church of the Minorites, under a monument built by his friend Guido Novello, on which was an epitaph written by Dante himself. Such, imperfectly sketched, was the career of the great poet; by it he gained a sense of the nothingness of earthly honors and prosperity possible only to the rich, and a knowledge of man possible only to the poor. In his youth living amid the excitement of the tented field and penning sonnets to his adored Beatrice; in his old age compelled "to climb the stranger's toilsome stairs, and eat the bitter bread of others." Out of his misfortunes the world found her rich account; the apocalypse of the Middle Ages, the 'Divina Commedia,' was begun and finished in his year of exile. Of this grand poem we can give only a very brief analysis. It is divided into three parts: Hell, Purgatory, and Heaven. Each part is subdivided into 33 cantos, in allusion to the years of our Saviour's life, the extra canto in the first part being introductory. Dante dreams that he had "reached the half-way point in his path of life, at the entrance of an obscure forest." He would advance, but three horrible beasts bar the way; then the shade of Virgil appears and offers itself as his guide. Dante accepts, and then takes place that wondrous journey in the "world of souls." Virgil tells him he can only accompany him through hell and purgatory; but that Beatrice shall conduct him through those happy spheres, the portals of which a pagan may not enter. Now begin the peregrinations of the Florentine through the regions of the damned, over the entrance of which is written the awful words—"All hope abandon ye who enter here." This is the most impressive and best-known part of the poem: the singular diversity of the chastisements; the rapidity with which Dante passes in review the great criminals of history; the intensity with which he paints, at a single dash, so to speak, their distorted features; the grace of certain episodes (the adventure of Francesca da Rimini, the death of Ugolino, and that of Manfred), attest a vigor of imagination never surpassed, if ever equaled. From Hell (which the poet places in the centre of the earth) he ascends to Purgatory, a solitary mountain rising from the ocean on the side of the globe opposite to us. This mountain is divided into terraces, and its top is the terrestrial paradise, the first abode of man. In Purgatory there are still scenes of pain and suffering; but these punishments are only temporary. The poet hesitates when he comes to a path filled with a sheet of flame; but Virgil speaks: "Between Beatrice and thee there is but that wall." Dante at once plunges into the heart of the flames. The two poets have now reached the earthly paradise, and behold Beatrice surrounded by a scene of surpassing magnificence; noble forests, whose trees are gently moved by celestial zephyrs; the melodious songs of birds to which the murmuring of the sacred woods and streams give harmonious re-

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ply; meadows of the freshest green, and groves of deepest shade. From this enchanting region Dante ascends, faster than tongue or pen can tell, into the celestial paradise. This realm consists of 10 heavens or circles. Dante roams at first over the seven planets, the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn; then he enters the eighth sphere, and at last into the empyrean. Each of these globes has its inhabitants, who are souls or spirits. Arrived at the eighth sphere, he looks down upon our globe; but the earth appears so abject that he smiles with pity upon it. Beatrice calls his attention to a nobler scene. "See the glorious company which surrounds the triumphant Redeemer." The eyes of the poet cannot sustain the splendor of the view. In the ninth sphere Dante feels himself in the presence of the Divine essence, hid from his sight by three hierarchies of angels. He sees the souls of the blessed on thrones in a vast amphitheatre, whose steps and circles widen into infinity. Beatrice takes her place upon her throne of glory; from that sublime height she smiles benignantly down upon the poet; then turns toward him who is the source of life and light. Thus ends the Divine trilogy, the noblest effort of the Middle Ages.

The name "Commedia" is derived from Dante's idea concerning the forms of eloquence, which were in his opinion tragic, comic, and elegiac, as he relates in his work 'De vulgari Eloquentia,' which was first written in Latin. What he called tragedy was a piece commencing with happy and peaceful scenes, and ending with events of a painful and terrible character, and what he called comedy was a piece which, beginning unpleasantly, terminated happily. The qualifying word *divina* was, however, added by others. We may mention the opinion maintained in 1753 by Bottari, that Dante made use of the 'Vision of Alberico' a monk who lived in the 12th century, in a monastery on Monte Cassino, in Naples. There have been many such visions from the earliest ages of Christianity; as, for instance, the 'Vision of an English Monk,' which Matthew Paris mentions in his 'History of England' (in the year 1196), and which resembled Dante's poem much more than the 'Vision of Alberico' published by Cancellieri in 1814 at Rome, with observations ('Osservazioni intorno alla Questione sopra la Originalità della Divina Commedia di Dante'). It is possible that Dante here and there may have borrowed a thought or image from those visions; but this is no fault: the recollections of great men are sparks which serve to kindle mighty flames.

There is no poet who bears so distinctly the impress of his age, and yet rises so high above it, as Dante. The Italians justly regard him as the creator of their poetical language, and the father of their poetry, which, regulated and controlled by his genius, at once assumed a purer and far nobler form than it had previously worn. The *terzina* first reached its perfection in the time of Dante, on which account he has been erroneously regarded as the inventor of it.

Florence soon recognized that she had lost her noblest son. In 1350 a sum of 10 golden florins was ordered to be paid by the hands of Giovanni Boccaccio to Dante's daughter, Beatrice, a nun in the convent of Santa Chiara at Ravenna. In 1373 an annual sum was granted for public lectures, to explain the 'Divine Comedy' in the churches, and Boccaccio was one

of the first lecturers. A monument was voted for if Ravenna would give up the now sacred remains, which that city refused, and has repeatedly refused to do. In May 1865 all Italy assembled at Florence to render homage to the seer who prophesied so confidently her unity; and the following year a colossal statue of the poet was erected on the Piazza della Croce.

The best editions of the 'Divina Commedia' are those of Lombardi (1791), frequently reprinted with valuable improvements, of Viviani (1823), of Bianchi (5th edition, Florence, 1857), of Karl Witte (Berlin 1862), etc. In 1821 Luigi Fantoni published an edition of the 'Divina Commedia,' stated to have been printed from a manuscript in the hand-writing of Boccaccio. In 1869 the 'Vernon Dante' was published in London by Lord Vernon, in three large volumes folio. It contains the text of the 'Inferno,' and, in Italian, an explanation of everything in the text regarding which any reader might have the least difficulty; together with an immense mass of information—biographical, topographical, historical, etc., relating to the life and times of Dante, and a large number of maps, plans, and illustrative plates. Dante's complete works appeared at Venice in 1757-8, published by Zatta (in 5 vols. 4to). His lyric poems, sonnets, and canzonets, of which some are beautiful, others dull and heavy, were written at different periods of his life. We have yet to mention his 'Banquet' (*Il Convito*)—a prose work worthy, says Bouterwek, to stand by the side of the best works of antiquity. It contains the substance of all his knowledge and experience, and thus illustrates his poetry and his life. The most popular English translation of the 'Divina Commedia' is that by Cary in blank verse (1814). Longfellow executed a faithful poetic version (1867); and that by Dean Plumptre in the original metre deserves mention. Other English translations are Boyd's (1785); Wright's (1833); Pollock's (1854); Parsons-Norton's (1891-2). The German translations are numerous, and are highly praised for faithfulness and force. The translation by Kannegieser is in the measure and rhyme of the original; that of Philaethes (King John of Saxony) has a deservedly wide reputation. The French have four or five translations, including one by Lamennais, but that graceful and feminine tongue is incapable of doing anything like justice to the manly thoughts of Dante.

In one respect Dante stands unrivaled by any man, as he, we might almost say, created the language, which he elevated at once to its highest perfection. Before him very little was written in Italian, Latin being the literary language; but no one attempted to use the *lingua volgare* for the purposes of dignified composition. The poet, indeed, thought it necessary to excuse himself for having written in Italian after having attempted to compose his poem in Latin. Thus he is to be regarded as the founder of Italian literature. One of the strangest productions of Dante is his 'De Monarchia.' He labors in this work to prove that the emperor ought to have universal authority and draws his arguments from the sacred Scriptures and from profane writers, which in this book appear very often with equal authority. The dialectics of the schoolmen are here exhibited in a most characteristic way. The 'De Monarchia' is valuable as a source of information respecting the great



struggle of the Guelfs and Ghibellines, and its influence upon the Christian world at that time. This struggle was a part of the great convulsion attending the separation of the civil power from the ecclesiastical, with which in the earliest ages it is always united. On the whole, Dante's works are important chiefly in three respects—as the productions of one of the greatest men that ever lived, as one of the keys to the history of his time, and as exhibiting the state of learning, theology, and politics in that age. To understand Dante it is necessary to be acquainted with the history and spirit of his time, particularly with the struggle of the Guelfs and Ghibellines, the state of the north of Italy, and the excitement caused by the beginning of the study of the ancients; also to have studied the Catholic theology and the history of the court of Rome, and to keep always in mind that Dante was an exile, deprived of home and happiness. The personal appearance and character of the man are thus described by Boccaccio: "Our poet was of middle height; his face was long, his nose aquiline, his jaw large, and his under lip protruding somewhat beyond the upper. His eyes rather large than small; his hair and beard thick, crisp, and black, and his countenance sad and pensive. His gait was grave and gentlemanlike, and his bearing, in public or private, wonderfully composed and polished. In meat and drink he was most temperate. Seldom did he speak unless spoken to, though he was most eloquent. In his youth he delighted in music and singing, and was intimate with all the musicians and singers of the day. He was of marvelous capacity and the most tenacious memory; inclined to solitude and fond of study when he had time for it."

*Bibliography.*—Balbo, 'Vita di Dante' (1839); Missirini, 'Vita di Dante' (1844); Fraticelli, 'Vita di Dante' (1861); Scartazzini, 'Dante Alighieri, seine Zeit, sein Leben, und seine Werke' (1897); Kraus, 'Dante, sein Leben und sein Werk' (1897); R. W. Church, 'Dante: an Essay' (1879); M. F. Rossetti, 'A Shadow of Dante' (1871); Lowell, 'Among My Books' (2d Series 1876); Moore, 'Textual Criticism of the Divina Commedia' (1889); Scartazzini, 'Dante in Germania' (1881-3); Symonds, 'Introduction to the Study of Dante' (1890); Butler, 'Dante: His Times and His Work' (1895); Botta, 'Introduction to the Study of Dante' (1887); Creighton, 'Historical Essays and Reviews' (1902).

**Danton, Georges Jacques**, zhōrh zhāk dān-tōn, French revolutionist: b. Arcis-sur-Aube 26 Oct. 1759; d. Paris 5 April 1794. He played a very important part during the first years of the French Revolution, of which he was an active and zealous promoter. His external appearance was striking: his stature was colossal; his frame athletic; his features harsh, large, and disagreeable; his voice shook the dome of the chamber of the assembly; his eloquence was vehement; and his imagination was as gigantic as his person. These qualities contributed to extend his influence, and he became one of the founders of the club of the Cordeliers. After the capture of Louis XVI. at Varennes he took the lead in the meeting of the Champ-de-Mars, which demanded the dethronement of the king. He was foremost in organizing and conducting the attack on the Tuileries (10 Aug. 1792), and a few days afterward was appointed minister of

justice by the legislative assembly in recognition of his services on that occasion. He also became a member of the provisional executive council, and usurped the appointment of officers in the army and departments. Money flowed from all sides into the hands of the minister, and was as profusely squandered on his tools and partisans. He endeavored by the terrors of proscription to annihilate all hope of resistance on the part of the Royalists. The invasion of Champagne by the Prussians, 2 September, spread consternation through the capital and among the members of the government. The ministers, the most distinguished deputies, and even Robespierre himself now assembled around Danton, who alone preserved his courage. He assumed the administration of the state, and prepared measures of defense; called on all Frenchmen capable of bearing arms to march against the enemy, and prevented the removal of the assembly beyond the Loire. The close of his celebrated speech has been often quoted: "Le tocsin qu'on va sonner n'est point un signal d'alarme, c'est la charge sur les ennemis de la patrie. Pour les vaincre, il nous faut de l'audace, encore de l'audace, toujours de l'audace, et la France est sauvée!" From this time forward he was hated by Robespierre, who could never pardon the superiority which Danton had shown on that occasion. He voted for the capital punishment of all returning emigrants, and undertook the defense of religious worship. The contest between the Girondists and the Mountain daily assumed a more serious aspect, and Danton appeared to fear the consequences of these dissensions. Danton wished to overthrow the despotism of Robespierre, and the crafty Robespierre endeavored to undermine him, in order to get rid of a dangerous rival. St. Just denounced him to the Committee of Safety, and Danton was arrested on the night of 31 March 1794, together with those who were called his accomplices. Being thrown into prison in the Luxembourg he maintained the appearance of serenity. When transferred into the Conciergerie his countenance became dark, and he appeared mortified at having been the dupe of Robespierre. All his discourses were a strange mixture of sorrow and pride. At his trial, on the formal question as to his name and residence being put, he answered, with perfect composure, "I am Danton, sufficiently known in the Revolution; I shall soon pass to nothingness, but my name will live in the Pantheon of history." On 5 April the revolutionary tribunal condemned him to death as an accomplice in a conspiracy for the restoration of monarchy, and confiscated his large property. He mounted the fatal car with courage, and without assistance; his head was elevated; his look commanding and full of pride. Before ascending the scaffold he was for a moment softened. "Oh my wife, my dear wife! shall I never see you again?" he exclaimed, but checked himself hastily, and, calling out, "Danton, no weakness!" ascended the scaffold.

See Robinet, 'Danton, Mémoire sur la vie privée' (1865); Bougeart, 'Danton' (1861); Dubost, 'Danton et la Politique Contemporaine' (1880); Gronlund, 'Ca ira! or Danton in the French Revolution' (1882); Beesley, 'Life of Danton' (1889); Morse-Stephens, 'Orators of the French Revolution' (1892); Belloc, 'Danton: a Study' (1899).

## DANTZIC — DANUBE

**Dantzic, Dantsic, or Danzig,** *dänt'sin*, Germany, city and port of Prussia, capital of the province of West Prussia, 253 miles northeast of Berlin; on an arm of the Vistula (now cut off by a dam from the river), about three miles above its mouth, and on the Mottlau, several arms of which traverse the town. It is one of the most important seaports under the Prussian monarchy, as well as one of its chief commercial entrepôts. It is nearly circular in form, and ranks as a fortress of the first class, being surrounded by walls and bastions, defended by a citadel and several outworks, and also provided with the means of laying a considerable part of the surrounding country under water. It is entered by four gates, has nine suburbs, and is divided into five parts—the Old, New, and Low town, the Speicher (granaries), an island, and Langgarten. The last is the more modern part of the town, and is regular and well built. The principal edifice is the Dom, or cathedral, begun in 1343, but not finished till 1503. It is 360 feet long by 142 feet broad, and its vaulted roof, 98 feet above the pavement, is supported by 26 slender brick pillars. It possesses a fine brass font and a curious astronomical clock, which has long ceased to move, but its chief attraction is a painting of the 'Last Judgment,' attributed to John Van Eyck. The other buildings and institutions deserving of notice are the town-house, the church of St. Catharine, the oldest in Dantzic, and other churches; three monasteries, convents, two synagogues, the exchange, an imposing Gothic edifice, built in 1379. Many of the modern public buildings are models of architecture. It is the seat of the provincial government, and contains the various offices connected therewith; and is also the residence of several foreign consuls. The industrial establishments include an imperial ship-building yard employing some 1,500 men, several other shipyards, works for artillery and fire-arms, iron foundries, machine shops, steel works, breweries, distilleries, works producing the liqueur called *Danziger Goldwasser*, or *Eau de Vie de Dantzic*, flour-mills, saw-mills, paper-mills, rope, wire, oil, chemical, soap, and glass works. Great efforts are being made to extend the manufacturing industries of the town, since as a shipping centre it seems to be declining owing to the competition of other ports, some of them more favorably situated. But the trade carried on is still very important, since the total value of exports and imports together amounts to about \$50,000,000 per annum. Much of the trade is of products in transit. Among imports the chief are coal, iron, cured herrings, salt, tallow, and lard, petroleum, rice, coffee, and some bread stuffs. The chief exports are timber, beet-sugar, grain and seeds, oil-cake, flour, spirits, and molasses. Dantzic has a great trade in grain, especially wheat, rye, and barley, for the warehousing of which there are immense granaries on the island of Speicher, capable of containing 100,000 tons. The wheat, which is chiefly Polish, is remarkable for both the quantity and the quality of the flour which it yields. There is considerable trade at Dantzic in amber, which is manufactured into various ornamental articles. The proper port of Dantzic is *Neufahrwasser*, at the mouth of the Vistula (now known as the dead Vistula), and connected with it by an artificial channel. Here a free port has recently been established. By dredging and otherwise,

various obstructions to navigation have been removed, and vessels of large size come up close to the town. The history of Dantzic reaches back to the times of historical obscurity. As early as 970 there was a town here. In 1271 it was taken by Mestwin, and in 1294 by the Poles. In the 14th century it fell into the hands of the Teutonic knights, under whose sway the town increased, and its commerce was extended. Left by the Teutonic knights, it again, in 1454, fell into the hands of the Poles, who granted it important privileges. After enduring many vicissitudes of fortune, on the second partition of Poland, in 1793, it came into possession of Prussia. It was besieged, bombarded, and taken by the French in 1807, and retaken by the Prussians in 1814. Since that time Prussia has done much for the town; but its commerce has never regained its former importance and extent. Pop. (1901) 140,563.

**Danube** (ancient, *DANUBIUS*; German, *DONAU*; Hungarian, *DUNA*), a famous river of Europe, originating in two small streams, the Brege and the Brigach, rising on the east slope of the Schwarzwald, a mountainous region of southwest Germany (the Black Forest), in the Grand-duchy of Baden, at an elevation of 2,850 feet above sea-level, and uniting at *Donau-eschingen*. Its general course is from west to east, and it flows into the Black Sea by four different outlets, called respectively the *Kilia*, *Stamboul*, *Sulina*, and the *Edrillis* or *St. George's* mouths. The *Sulina* mouth or channel is the deepest. The extent of the basin of the Danube is about 300,000 square miles, and its total length is about 1,875 miles. The Danube basin comprises portions of Austria-Hungary, Germany, Serbia, Bosnia, Rumania, and Bulgaria. From its source it flows northeast to *Ratisbon*, in Bavaria, whence it takes a southeast course, by *Vienna* and *Pressburg*, to *Waitzen*, in Hungary. Here the course is changed to nearly due south to the point where it receives the waters of the *Drave*, near *Esseg*, in Slavonia; thence it flows southeast to *Belgrade*, on the north boundary of Serbia, and for some distance it forms the boundary between Serbia and Austria. The course continues in an easterly direction to *Orsova* (the Iron Gate), where it changes to southeast, then again nearly east, forming for a long distance the boundary line between Rumania and Bulgaria. At *Silistria*, in Bulgaria, it turns more to the north, through Rumania to *Galatz*, then southeast between Rumania and Bessarabia, in Russia, and finally into the Black Sea.

The great basin of the Danube has been divided into four minor basins. The first consists of a vast plateau 1,640 feet above sea-level, 150 miles in length, and 125 miles broad, surrounded by mountains, and comprising a portion of the principality of *Hohenzollern*, part of the kingdom of *Württemberg*, and the greater part of the kingdom of *Bavaria*. This tract is by far the most fertile and most populous through which the Danube passes during its entire career. The principal branches within this space are the *Iser* and *Lech*.

The second basin belongs to the empire of Austria, having *Vienna* nearly in its centre, and comprising the archduchy of Austria, Hungary as far east as *Waitzen*, and *Styria*. It is very irregular, and is bounded by very high moun-

## DANUBE NAVIGATION COMMISSION — DANVILLE

tains. The soil is rich in mineral products, and the climate one of the best in Europe. The principal branches in this basin are the March or Morava, and the Enns—the former from the left, and the latter from the right. The Danube here passes through a succession of the most picturesque scenery.

The third basin of the Danube comprises Hungary east of Waitzen, and the principality of Transylvania, and consists of an immense plain, almost without undulations of any kind, and only 394 feet above the sea-level. It is intersected by large rivers with marshy banks, and interspersed with stagnant pools, saline and sandy wastes. It comprises about one half of the entire basin of the Danube. The marshes cover a space of 3,053 square miles. The principal branches in this basin are the Save, the Drave, and the Morava. From Budapest to Belgrade the river passes through an immense plain covered with sand and alluvium, through which it is constantly forming new channels and filling up the former ones. Below Moldava it passes for 60 miles through a succession of rapids and shallows, interspersed with rocks and sandbanks, where it has cut a passage for itself through the cross chain of hills which connect the Carpathian Mountains with the Alps; and between Drenkova in Hungary, and Scala Kladova in Serbia, the navigation is partially interrupted by three great rapids, the principal or last and lowest of which is the famous Iron Gate, where the stream rushes through a narrow channel between stupendous rocks, ending with a series of whirlpools, eddies, and smaller falls. By the removal of various obstructions vessels drawing nine feet have long been able to pass at certain seasons; and by works carried out in 1890-6, and extending over some 50 miles, a permanent waterway has been secured.

The fourth basin comprises Rumania, a portion of Bessarabia, and Bulgaria. This tract is flat, inundated, and marshy along the banks of the river; dry and mountainous on the borders of the basin. The principal branches in this basin are the Aluta, Sereth, and Pruth. In the lower part of its course the Danube increases in width from 1,400 to 2,100 yards; and in one part it forms an expanse of water like a sea, and is studded with islands. Excepting between Drenkova and Kladova, the Danube may be said to be navigable for steamers from Ulm to the sea, although in some places navigation is rendered difficult by shallows and sandbanks, intersected by narrow and intricate channels. The outlets of the Danube are separated from each other by several low islands covered with reeds and trees. The greater part of the ships bound up the river enter it by the Sulina mouth. The Danube has 60 navigable tributaries, and its volume of water is nearly equal to that of all the rivers that empty themselves into the Black Sea taken together. Its rapidity is in many places above Orsova so great as to render navigation difficult, but below that point its current is less rapid. A number of steamers now ply on the river between its principal towns. The principal towns on the banks of the Danube are Ulm, in Wurtemberg; Regensburg (Ratisbon) and Passau, in Bavaria; Linz and Vienna, in Austria; Pressburg, Budapest, and Peterward-ein, in Hungary; Belgrade, in Serbia; Widin, Nicopolis, Rustchuck, and Silistria, in Bulgaria; Brahamlow and Galatz, in Rumania.

**Danube Navigation Commission**, an international commission, constituted in 1856, when at the Peace of Paris the navigation of the river was declared free to all nations. It was composed of delegates of all the great powers, to whom a representative of Rumania has been added since 1878. It was appointed on the express condition that it should dissolve in 1858, but such was its usefulness that it was informally continued till 1866, when the Conference of Paris formally prolonged its powers for five years. In 1871 the Conference of London continued the commission for 12 years, and in 1883 a second London conference extended its existence for 21 years. It exercises almost sovereign power on the mouths of the Danube, where it has conducted great engineering works; it has its own flag, uniform, and revenue, and has raised loans, made laws, and maintained its own small army of police. Its jurisdiction, originally limited to the river between Isaktcha and the sea, was extended at the Congress of Berlin (1878) as far as Galatz, and afterward to the Iron Gate; but in the last-named portion of the stream its authority is exercised only by delegation to the Riverain Commission of the states on the bank, or on appeal from its decisions.

**Danubian Principalities.** See MOLDAVIA; RUMANIA; WALLACHIA.

**Danvers, Mass.**, town in Essex County, on the Boston & Maine Railroad, five miles northwest of Salem. It was a portion of Salem till 1756, and the Salem village parish where the witchcraft excitement broke out is included in the present Danvers. It is the seat of Peabody Institute, founded by George Peabody, a resident of the place, who in 1852 donated \$200,000 for the promotion of knowledge and morality among the inhabitants. It is also the seat of Danvers Insane Asylum, built at a cost of \$2,000,000, and has extensive manufactures of shoes, bricks, and carpets, and has foundries, rolling mills, tanneries, churches, high school, weekly newspapers, public library, a national bank, and good public and private schools. Pop. 8,600.

**Danville, Ill.**, city, county-seat of Vermilion County; on the Vermilion River, and the Wabash, Chicago, and Eastern Illinois, and the Cleveland, Cincinnati, Chicago & St. Louis railroads; 125 miles south of Chicago. It has a National Soldiers' Home for disabled veterans, with over 3,500 inmates. Its chief industry is coal mining, which is carried on extensively on the bluffs of the river. It also has large railroad car and machine shops, iron foundries, planing-mills, carriage and wagon factories, organ and furniture factories as well as churches, a high school, three national banks, daily and weekly newspapers. Pop. (1900) 16,354.

**Danville, Ind.**, county-seat of Hendricks County; situated on the Cleveland, Cincinnati, Chicago & St. Louis Railroad, about 20 miles west of Indianapolis. The manufacture of flour and lumbering are the principal industries. It is the site of the Central Normal College, a private institution. Pop. (1902) 1,802.

**Danville, Ky.**, city, county-seat of Boyle County; on Dick's River, and the Cincinnati Southern Railroad, 42 miles south of Frankfort. It is a stock-raising centre, and the seat of several educational institutions among them

## DANVILLE — DAPHNIS

the Danville Theological Seminary, the Southern Collegiate Institute, Center College, the Caldwell Female Institute, and also the State Asylum and School for Deaf-mutes. It has churches, public schools, three national banks and weekly newspapers. Pop. (1900) 4,285.

**Danville, Pa.**, a borough and county-seat of Montour County; on the Susquehanna River; and on the Pennsylvania, the Lackawanna, and the Philadelphia & Reading railroads; 154 miles northwest of Philadelphia. Danville is in a district abounding with iron ore, limestone, and anthracite coal; and contains the first establishment erected in the United States for the manufacture of railroad iron. It still ranks among the most extensive iron manufacturing places in the country. There are blast furnaces, iron foundries, rolling-mills, churches, two national banks, the Danville Institute, a State asylum for the insane, and daily and weekly newspapers. Pop. (1900) 8,042.

**Danville, Va.**, city and county-seat of Pittsylvania County, on the Dan River, 140 miles southeast of Richmond, on the Danville & Western and the Southern R.R.'s. One of the oldest cities in the South; incorporated as a town in 1792. For a short time during the last days of the Southern Confederacy it was the seat of government. It is located in the famous and picturesque Piedmont section of Virginia, on a gradual slope extending from the river to an altitude of 600 feet above the sea. The river furnishes power for the cotton-mills, flour-mills, foundry, ice factory, and electric-light plant; and further development of its water power is now being made about three miles up the river, at an estimated cost of \$2,000,000. Danville is the largest loose tobacco market in the world, her average annual sales being 50,000,000 pounds. The surrounding country is well adapted to grain, fruits, and tobacco. The improvements in public utilities within the past three years include larger water mains in the down-town district (16 inch), and additional fire engines (not including further improvements now under consideration) at a cost of \$23,000; Main street repaved with Belgian block and Mack brick, \$100,000; Craghead street, same material, \$24,500, and several other less important streets paved with cobble. Further extension of the sewerage system from time to time as the growth of the city requires; new electric-light plant owned by city, with new \$5,000 incandescent machine, furnishing lights for streets, business, and dwelling-houses; electric railway system rebuilt at a cost of about \$320,000, first-class equipment, double track on Main street, about eight miles of track, new power-house, with double set of dynamos and engines. The Southern Bell Telephone and Telegraph Company has expended about \$30,000 in improvements, and the growth of their business has been such as to require a much larger additional switchboard, which was installed recently. Danville is the seat of Roanoke Female College (Baptist), established 1859, Randolph Macon Institute for Young Ladies (Methodist), founded in 1883, and Danville Military Institute, established in 1890. The climate of the city is mild and pleasing, the streets well shaded and paved, and as a residential city it is excelled by few locations in the South. There are many new public buildings, churches, and schools; a general hospital recently enlarged and fitted with the latest improvements, seven banks

—one national, five State, and one private, and two daily newspapers. Under the new constitution of the State the municipal government is administered by a mayor, elected quadrennially, and a city council, composed of two branches having different numbers, which controls appointments to most of the administrative offices. The water works, electric light and gas plants are owned and operated by the municipality. Pop. (1890) 10,303; (1900) 16,529.

**Danzig.** See DANTZIC.

**Daphænus**, an extinct genus of *Canidae* of the Oligocene Epoch in North America. It has many primitive characters, such as small brain, long tail, short limbs, and five toes on each foot, with somewhat retractile claws. The third upper molar tooth, lost in all modern dogs, was present in *Daphænus*, giving it the complete primitive series of 44 teeth. It is considered to be a nearly direct ancestor of the modern dogs, wolves and foxes. The Carnegie Museum, Pittsburgh, has a complete skeleton from Dakota.

**Daphne**, a famous grove near Antioch, planted by Seleucus Nicator, who erected a temple there and dedicated it to Apollo and Diana. It was a place of pagan pilgrimage noted for its license, until the spread of Christianity caused its abandonment. A graphic description of this grove is given in 'Ben Hur.' For Daphne in Egypt see TAHPENES.

**Daphne**, a genus of plants belonging to the *Thymelæacea* or *mezereum* family. The genus has about 40 species, natives of Europe and Asia. The single American species is the spurge or lady laurel (*D. mezereum*), found in northern New England and New York as a fugitive from cultivation. These plants are common in temperate climates in Europe and Asia, and are valuable commercially. From the bast of some species fibres are obtained, and most of the paper used in Central Asia is made from some species of the daphne. The inner bark of *D. lagetta*, when cut into thin pieces after maceration, assumes a beautiful net-like appearance, whence it has received the name of lace-bark. The bark of the spurge-laurel (*D. mezereum*) is used in decoction as a diaphoretic in cutaneous and syphilitic affections. In large doses it is an irritant poison, causing excessive purging. Used externally it acts as a vesicant. It contains a ventral crystalline principle called daphnein. The fruit is poisonous. The barks of *D. gnidium*, *D. alpina*, *D. cneorum*, *D. poncica*, and *D. laureola* have similar properties. The berries of the last are poisonous to all animals except birds.

**Daphnepho'ria**, one of the most ancient and important of the Greek festivals, observed in honor of Apollo.

**Daph'nin**, a glucoside having the formula  $C_{18}H_{16}O_8$ , and occurring in the bark and blossoms of certain species of plants belonging to the genus *Daphne*. It is slightly soluble in cold water, from which it crystallizes in rectangular prisms containing two molecules of water. It is insoluble in ether, but readily dissolves in boiling alcohol. It reduces Fehling's solution slowly, and by the action of emulsin or of dilute acids it is converted into glucose and a substance called daphnetin, or di-oxy-coumarin.

**Daphnis**, in fabulous history, the son of Hermes (Mercury) by a nymph, educated among the nymphs, and celebrated in the Sicilian traditions as the author of bucolic poetry,

## DAPHNIS AND CHLOE—DARBY AND JOAN

and also as a performer on the shepherd's pipe. He pastured his flocks upon Mount Ætna. The nymph Echenais, who loved the youth, threatened him with blindness if he should love another; but being intoxicated with wine by the daughter of a Sicilian prince, he forgot the warning, and thus brought upon himself the threatened punishment. Some say that he died of grief; others that the nymph transformed him into a stone. All the nymphs bewailed his death, and Hermes raised him to the heavens. On the spot where he died flowed a fountain, at which the Sicilians afterward performed yearly sacrifices.

**Daphnis** (dǎf'nís) and **Chloe**, klō'ē, a pastoral romance written in Greek during the 4th or 5th century of our era and ascribed to Longus. Many English, French, and Italian pastorals were suggested by this work; but the one derived most directly from this source is Saint-Pierre's 'Paul and Virginia.' The scene of the Greek tale is laid in the island of Lesbos. A goat-herd named Lamón finds one of his goats suckling a fine baby boy, and adopts him as his own child, calling him Daphnis, and bringing him up to herd his goats. A neighbor, Dryas, discovers a baby girl nourished by a ewe in the grotto of the nymphs. She is adopted under the name of Chloe. The two young people pasture their herds in common, and are bound by a child-like affection, eventually deepening into love. Daphnis sues for the hand of Chloe. He is accepted by her foster-parents; but the marriage is deferred till the arrival of Lamón's master who proves to be the father of Daphnis. Chloe is identified as the daughter of a wealthy Lesbian. The young people are married with great pomp, but return to their pastoral life, in which they find idyllic happiness.

**Dapitan**, dā-pē'tān, Philippines, a Spanish province or comandancia in the northwestern part of the island of Mindanao. There are numerous rivers navigable for the native boats, and these are the chief means of communication in the province. Hemp, cotton, sugar, etc., are cultivated for domestic consumption; the forests, particularly the ebony, are valuable. There is some export trade in gums, wax, honey, cacao, etc. Pop. 20,270.

**Da Ponte, Lorenzo**, lō-rēnd'zō dā pōn'tē, Italian dramatist and author: b. Venice 10 March 1749; d. New York 17 Aug. 1838. He wrote the libretti for Mozart's operas 'Don Giovanni' and 'Figaro.' He came to America in 1805, and in 1828 was professor of Italian in Columbia College. He wrote many plays, sonnets, and translations, and published several works of instruction in the Italian language; also his own 'Life' (1823); 'History of the Florentine Republic and the Medici' (1833).

**Darbhāngah**, dā-bān'gā, India, (1) a district in Bengal. In the rainy season the district becomes inundated by the overflow of the rivers Kamlā and Little Bāghmati. Area 3,335 square miles; pop. 2,633,477. (2) A town of the same name is the capital of the district. It is situated on the Little Bāghmati, and is the residence of the Maharaja of Darbhāngah. The chief exports are oil-seeds and timber. Pop. 73,561.

**D'Arblay**, dār-blā (MADAME), **Frances Burney**, English novelist, daughter of Charles Burney: b. King's Lynn, Norfolk, 13 June 1752; d. Bath, England, 6 Jan. 1840. After she had

published 'Evelina, or a Young Lady's Entrance into the World' (1778), she became the favorite of the literary men of the day, especially Dr. Johnson. Her second novel 'Cecilia' (1782) was no less admired. In 1786 she was made second keeper of the robes to Queen Charlotte, and in 1793 was married to M. D'Arblay, a French army officer. Her other books are 'Camilla' (1795), and 'The Wanderer, or Female Difficulties' (1814). Her 'Diary and Letters,' edited by her niece (1842-6), surpass in modern estimation the rest of her writings. The record begins with 'Evelina.' The success of her first effort, the dinings, winings, and compliments that followed, are recorded with a naïve garrulousness perfectly consistent with simplicity and sincerity. She also wrote memoirs of her father (1832). 'Evelina' and 'Cecilia' were published with introductions by Annie R. Ellis (London 1881-2).

**Darboy, Georges**, zhōrhzh dār-bwā, Archbishop of Paris: b. Fayl-Billot, department Haut of the Commune, 16 Jan. 1813; d. Paris 24 May 1871. He was admitted to the priesthood 1836, and began regular parish work; but in 1839 became professor, first of philosophy, then of dogmatic theology in the ecclesiastical seminary of Langres. Removing to Paris in 1846 he was for a while attached to the College of Henry IV. and was also editor of the journal 'Moniteur Catholique'; in 1854 he was appointed vicar-general of the archbishop of Paris and inspector of religious instruction in the schools of the diocese, that is, superintendent of the Christian doctrine work in the diocese. In 1859 he was consecrated bishop of Nancy, and in 1863 was appointed successor to Archbishop Sibour of Paris, who had been slain by an assassin. In the Vatican Council he was one of the leaders of the minority who opposed the declaration of papal infallibility on the ground that such a declaration was inopportune; but after the definition he was one of the first among its former opponents to make submission. In the siege of Paris by the German armies he won universal approval for his devoted labors in relieving the wounded and succoring the distressed; and when the Communists, known to be his mortal foes, came into control of the city, he refused to seek safety outside the walls. Arrested by the Commune and held as a hostage, he with other hostages was fusilladed to death in the yard of the prison of La Roquette, 4 April 1871. The end came while he was in the attitude of blessing his assassins and invoking forgiveness for them. It was not a mere accident or coincidence that he was the author of a 'Life of St. Thomas à Becket' (1859), that archbishop of Canterbury who was slain by assassins before the high altar of his cathedral church 700 years before; within 23 years he had seen his two nearest predecessors, archbishops of Paris, murdered, one by an individual assassin, the other (Affre) by the insurgent populace. In addition to his scholarly work, 'The Life of St. Thomas à Becket,' he wrote a new translation of 'Dionysius the Areopagite,' and also a translation of the 'Imitation of Christ.'

**Darby and Joan**, the names of a married couple traditionally reported to have lived in the West Riding of Yorkshire in the 18th century and been remarkable for their long and happy life together. A ballad entitled 'The Happy



Old Couple,' by Henry Woodfall, commemorates their excellencies. Humdrum, uneventful married life is sometimes referred to as a "Darby and Joan" existence.

**Darbyites**, a name often applied to the Plymouth Brethren (q.v.) from their principal founder, John Nelson Darby (1800-82), of whose collected writings 32 volumes have appeared (1867-83). See his 'Personal Recollections' (1881).

**Darbyshire**, Alfred, English architect: b. Salford, Lancashire, 1839. He began the practice of his profession in 1862 at Manchester and has designed many buildings of importance there and elsewhere. He has published 'Experiences of an Architect, Professional, Artistic, and Theatrical'; 'A Book of Old Manchester and Salford.' He was art critic of the *Manchester Guardian*, 1868-74, and has acted in a similar capacity for the *Manchester Courier* from 1875 to the present.

**Darcet**, Felix, fā-lēks dār-sā, French chemist: b. Paris about 1807; d. there 18 Dec. 1846. He was a son of Jean Pierre Darcet (q.v.); studied medicine and became a physician, but paid some attention to chemistry, and published researches on the preparation of hydriodic acid, on the action of iron at a high temperature on benzoic acid and on camphor, on succinic acid, on arsenovinic acid, on chloroethereal.

**Darcet**, Jean, zhōn, French physician and chemist: b. Douazit 7 Sept. 1725; d. Paris 13 Feb. 1801. He accompanied the celebrated Montesquieu to Paris in 1742, and remained with him till his death as a literary assistant. He afterward devoted himself to chemistry, especially to technical chemistry, was appointed professor of chemistry in the College of France, and regent of the medical faculty. Darcet made many experiments with a view to the improvement of the manufacture of porcelain. He also tried the effect of fire on the various kinds of earths, and demonstrated the volatility of the diamond. In 1776 he published a memoir on the geology of the Pyrenees. He succeeded Macquer as a member of the Academy of Sciences and director of the manufactory of Sèvres. He was afterward appointed inspector-general of the assay of coin and inspector of the Gobelins manufactory. He made several important chemical discoveries, and contributed much to the present improved state of the science. A fusible alloy of lead, bismuth, and tin is named after him.

**Darcet**, Jean Pierre Joseph, zhōn pē-ār zhō-zef, French chemist: b. Paris 31 Aug. 1777; d. there 2 Aug. 1844. He was a son of Jean Darcet (q.v.). He began his chemical studies early with his father and with Vauquelin. In his 24th year he was made assayer of the mint, and from that time devoted himself chiefly to chemistry in its application to the arts. Being employed by the government in the manufacture of gunpowder, he rendered its preparation much more easy by new processes. He greatly assisted in extending the manufacture of soda artificially, succeeded in producing alum equal in quality to that of Italy, brought the art of stereotyping to greater perfection, facilitated the preparation of sulphuric acid, investigated the best alloys for cannon, for cymbals and tam-tams, and for statues, etc. Among his other discoveries were the extraction of soda

from chestnuts, the preparation of sugar from the same material, and the extraction of jelly from bones by means of an acid. He also made another discovery of great importance, whereby he obtained the prize of 3,000 francs which Ravrio had provided for the discovery of the means of protection against the fine dust of quicksilver, which had been so unhealthy to the gilders. Darcet's discovery completely attained the object.

**D'Arcy**, Ella, English novelist: b. London. She was educated in France and Germany and has published: 'Monochromes' (1895); 'The Bishop's Dilemma' (1898); 'Modern Instances' (1898).

**Dardanelles**, dār-da-nēlz' (ancient HELLES-PONT), a narrow channel, in the Turkish dominions, which connects the Sea of Marmora with the Aegean Sea, and separates Europe from Asia. It is about 40 miles in length, varying in breadth from one to four miles. There is always a rapid current in the channel, the volume and velocity of which is much increased by the prevailing winds, which blow in the same direction with the stream for at least 10 months in the year. The modern name of this strait is derived from the castles, called the Dardanelles, built on its banks, at its southwest entrance; its ancient name, Hellespont, from Helle, daughter of Athamas, king of Thebes, who was fabled to have been drowned in it. Xerxes on his great expedition against Greece, in 480 B.C., crossed this strait by means of two bridges of boats, constructed in the neighborhood of Sestos and Abydos. It is also renowned as the scene of the death of Leander, who, it is said, used to swim across from Abydos on the Asiatic side, at the narrowest part of the strait (but yet about a mile in width), to visit Hero of Sestos on the European side. This feat of swimming the channel was also performed by Lord Byron, who achieved it in 1 hour and 10 minutes. To protect Constantinople, coast batteries have been built since 1807, on both the Asiatic and the European side. These batteries have latterly been supplied, in part at least, with ordnance of recent type, such as the guns made by Krupp. In 1770 the Turkish defenses were almost in ruins. Warned by the condition of the batteries when a Russian squadron appeared before the castles, the Turkish government ordered the defenses repaired; but they were again allowed to become almost useless until 1807. In that year a British squadron passed the Dardanelles and appeared before Constantinople, which until then had never seen an enemy's fleet. In 1854, during the Crimean war, the castles and other defenses of Constantinople were again put in repair. It had long been recognized that the Turks had a right to prevent any foreign ship of war from passing the Dardanelles, and in 1841 a treaty was signed between the five great European powers and the Porte, in which it was laid down that this was not to be permitted. The treaty was confirmed in 1856, the Sultan, however, retaining the right to permit certain vessels belonging to foreign governments to pass. By the Berlin treaty of 1878 the duty was again imposed upon the Sultan to prevent the passage of any foreign ship of war.

**Dardanus**, dār-da-nūs, in mythology, the progenitor of the Trojans, and so of the

Romans, and the son of Zeus and Electra, the daughter of Atlas. He emigrated from Samothrace (according to some accounts, from Arcadia, or Crete), and settled in Phrygia, in the country which was afterward called Troas. Here he built a city, which, from him, was called Dardanum, or Dardanus, and introduced the worship of Athena (Minerva).

**Dardistan**, dār-dīs-tān', the name given to a region of central Asia, bordering on Balistan, the northwest portion of Cashmere. This country, which consists of lofty mountains, is little known, and its limits are variously given; but its interest depends mainly on the fact that its inhabitants, the Dards, are an Aryan people, speaking a Sanskritic tongue mixed with Persian words. They have been called "Stray Aryans in Tibet," and are Moslems converted from Buddhism at a comparatively recent period. The rajah of Cashmere is constantly endeavoring to subject them completely to his authority. The chief districts are Hasora, Gilghit, and Tassin; some authorities also include Chitral in Dardistan.

**Dare, Virginia**, first child of English parents in the New World: b. Roanoke August 1587, and named after the district of Virginia. She was the granddaughter of John White, who was governor of the colony sent by Sir Walter Raleigh to found an agricultural state, which sailed from Plymouth, 26 April 1587, and reached the shores of Virginia in July of the same year. White's daughter was married to Mr. Dare, who was one of the assistants of the governor, and Virginia was born about a month after the arrival of the expedition.

**Darfur**, dār'fūr, or **Darfoor** (Country of the Fur, a tribe of negroes), a region of central Africa, occupying a large portion of the area between Abyssinia and Bornou, and forming part of the Egyptian Sudan. It may be considered as lying between lat. 10° and 16° N., and lon. 22° and 28° E.; area, 150,000 square miles. On the east it has Kordofan; on the west, Wadai; on the north, the desert; while the regions to the south are occupied by barbarous nations. The most important physical feature is the Djebel Marrah, a chain of mountains near the centre of the country, of a crescent form, lying north and south and reaching the height of 6,000 feet. Some of the peaks are extinct volcanoes. There are other subordinate chains and elevated masses. There seem to be no permanent streams, the water-courses being filled only temporarily. The country belongs mainly to the Nile basin, partly to that of Lake Chad. Large portions of it are barren or are covered with verdure only in the rainy season. The inhabitants are of various races, some of them of the negro type, others having little of the negro character, and a considerable number being Arabs. The Fur or For, who give name to the country, inhabit the mountainous central parts, and are of a brownish-black color with negro features. Mohammedanism is the religion of the country, and to it is due what little civilization the people possess; but the natives are still semi-barbarous. Their occupation is chiefly agriculture. A few of the mechanical arts are carried on, and in particular the people manufacture a considerable variety of articles, including cotton goods, pottery, leather, lance-heads, etc. Their houses are rudely constructed

of clay and reeds, and with scanty accommodation. Among the exports the most important are camels, ivory, the horns, teeth, and hide of the rhinoceros and hippopotamus, ostrich feathers, gum, and copper. The imports comprise beads, glass, arms, light cloths of different kinds, silks, shoes, and other manufactured articles. Darfur was an independent kingdom till annexed by Egypt in 1874. During the ascendancy of the Mahdi and his successor it was independent; but it is now recognized as within the "sphere of influence" of Great Britain. The capital is El Fasher. Pop. 4,000,000.

**D'Argenson, Marc Pierre**, mārċ pē-ār dār-zhān-sōn, Comte, French statesman: b. 1696; d. Paris 1764. He was the younger son of the Marquis d'Argenson (1652-1721), who created the secret police and established the *lettres de cachet*. He became war minister in 1743, at a time when the very political existence of France was imperiled, and by his vigor and lucky choice of generals changed the fortunes of the war in the course of a single year. After the peace of Aix-la-Chapelle (1748), he devoted himself to the improvement of the military system, and in 1751 established the *Ecole Militaire*. He was an illustrious patron of literature. Diderot and D'Alembert dedicated to him their great 'Encyclopédie'; and to Voltaire, whose fellow-student he had been, he furnished materials for his 'Siècle de Louis XIV.' In 1757 he was banished to his estate by the machinations of Madame Pompadour; but on her death he returned to Paris.

**Dargomyzhsky**, dār-gō-mīzh'skē, or **Dargomijsky**, Alexander Sergievitch, Russian composer: b. village of government of Toula, 2 Feb. 1813; d. St. Petersburg 29 Jan. 1869. He composed the music for the libretto of 'Esmeralda,' which Victor Hugo wrote for Louise Bertin, many piano pieces, 100 romances, airs, and duets for the voice, symphonic and choral fantasies and a "cantata-ballet," called 'The Festival of Bacchus,' besides the opera of 'La Roussalka,' his happiest effort, given at St. Petersburg in 1856. After this he tried to form a new school, dying before the completion of his opera, 'The Guest of Peter,' which was finished by friends and given in 1872 without much success.

**Daric**, dār'ik, properly **Daricus** (Gr. *δαρείος*), an ancient Persian coin of pure gold, specimens of which are still preserved in several European collections, bearing on one side the image of a kneeling archer, on the other that of a royal palla. It was known to the Greeks, Romans, and Jews; the latter used it after the Babylonian captivity, under the reign of the Persians, and called it *adarkon* or *darke-mon* (mentioned in the first book of Chronicles, by Esdras and Nehemiah). Its value was equal to 20 silver drachmæ, or 16 shillings 3 pence; 3,000 being equal (according to Xenophon) to 10 talents. Its name is variously derived from that of King Darius Hystaspes, who regulated the Persian currency, and from several Persian words meaning king, palace, and bow. The so-called silver darics were not designated by this name in antiquity.

**Darien**, dā'rī-ən, Ga., city, county-seat of McIntosh County; on the Altamaha River, and the Darien & Western Railroad; about 65 miles southwest of Savannah, and about 10 miles



## DARIEN — DARIEN SCHEME

from the ocean. Lumber, rice, and vegetables are sent from here to the markets along the coast. Pop. 2,000.

**Darien**, dā'rī-ən, Sp. dā-rē-ān', **The Colony of**, established by the Spaniards on the Gulf of Urabá (See **GULF OF DARIEN**), in the first decade of the 16th century, was the centre from which exploring expeditions were sent out until Panamá was founded in 1519. A notary of Triana, named Bastidas, sailed along the Caribbean coast of the isthmus in 1501, Balboa being one of his companions. At the end of 1502 and beginning of 1503 Columbus carefully examined the region immediately west of this gulf. In 1508 the king granted to Nicuesa the territory from the Gulf of Darien to Cape Gracias á Dios; to Ojeda, the territory from the Gulf of Darien to Cape de la Vela. The dividing line was more precisely fixed by the grantees, who agreed that it should be the Atrato River. (See **DARIEN, GULF OF**.) In the event the only permanent settlements were made near this river and the gulf into which it flows. Ojeda first landed at Cartagena (1509), where his expedition endured great hardships. Removing thence to the eastern side of the Gulf of Urabá, he built the fort called San Sebastian, which he entrusted to Francisco Pizarro, and then returned to the West Indies. Pizarro, Balboa, and all who remained alive set sail for Cartagena once more. There they were met by Enciso, with re-enforcements from San Domingo, and after some hesitation, crossed the gulf to the western shore, where the colony of Santa Maria de la Antigua del Darien was established in 1510. Balboa gained ascendancy by recommending the selection of this place (which he had visited with Bastidas), and became the leading spirit in the undertakings which followed—the expedition to Dabaiba, the crossing of the isthmus, etc. (see **BALBOA**).

Nicuesa's expedition, though it started under brighter auspices, resulted in a lamentable failure. Its courtly leader, after losing nearly all his followers near Cape Nombre de Dios, was forced to put to sea in a boat that could not outlive a single storm—practically condemned to death by the authorities at Darien, whom he had offended. In 1514 Pedrarias Davila superseded Balboa as governor. Five years later Panamá was founded; the capital was established on the Pacific coast; exploration northward and southward began along the shores of the newly discovered ocean; the isthmian traffic sought and found an easier route, better harbors, and a less deadly climate at a distance from the Gulf of Urabá. Darien was abandoned. See **CENTRAL AMERICA**; **SOUTH AMERICA**.

**Darien, Gulf of**, also called **The Gulf of Urabá**, an extension of the Caribbean Sea forming a wedge-shaped indentation in the northern coast of Colombia; of great width between Colón and Cartagena, but narrowing toward the south until it becomes an estuary of the Atrato River. A distinction to be commended on the ground of convenience is that which would restrict the name Urabá to the southern portion, which is about 7 miles wide by 30 long. Some of the earliest Spanish settlements, at the beginning of the 16th century, were located on the Gulf of Urabá (see **DARIEN, THE COLONY OF**); the region has not prospered, however, owing to the lack of good

harbors; to the extremely unhealthful, hot, and damp climate of the coast at this point; and the diversion of isthmian traffic to Colón and Parana.

**Darien, Isthmus of**, the neck of land uniting South and Central America; more specifically, the lower portion which is narrowed between the gulfs of Urabá and San Miguel, while its prolongation on the northwest, between the Caribbean Sea and the Gulf of Panamá, is called the Isthmus of Panamá. It is traversed by the Cordillera de Baudó. Its principal rivers are the Tuira (also called Darien), which rises in the heights of Aspaves, receives the waters of a number of tributaries, and flows into the Gulf of San Miguel, and the Atrato, which comes out of the department of Cauca and empties into the Gulf of Urabá. In regard to the climate on the coast, see **DARIEN, GULF OF**. A Colombian official publication says: "The interior of the Isthmus of Darien is very sickly, and only the negroes and Indian half-breeds can stand its excessively rainy climate, hot and damp, and its atmosphere, which the marshes make malarious. Though about the Darien cordillera the temperature is milder, it cannot be said that the region is salubrious; and it will never be until the great woods and groves shall have disappeared." The woods in question, especially in South Darien, are of excellent quality and colossal growth, constituting a source of wealth. Gold is obtained from the rivers Balsas and Marca, and the mines of Cana or Espiritu Santo, near the Tuira River, were famous in the old days. For other natural resources, etc., see **PANAMÁ, DEPARTMENT OF**; for historical sketch, see **DARIEN, THE COLONY**.

**Darien River**, the name sometimes given to two streams in the Republic of Colombia: (1) A river emptying into the Gulf of Urabá, on the banks of which Balboa and others founded in 1510 the town of Antigua del Darien (see **DARIEN, THE COLONY**); (2) the Tuira River (see **DARIEN, ISTHMUS OF**).

**Darien Scheme**, a celebrated financial project, conceived and set afloat by William Paterson, a Scotchman, toward the close of the 17th century. It is said that he was originally a buccaneer, that he was a clergyman, and that he was a merchant; the probabilities are on the side of the last assertion, as he possessed a wide knowledge of commerce and finance. He was undoubtedly a man of an original mind, and of a bold and enterprising disposition. He was the first projector of the Bank of England, and being defrauded of his just recompense by those who adopted his plans, he resolved to confine his future schemes to the benefit of his native country. On his original and ostensible design of establishing an East India trade in Scotland, he ingrafted the secret and magnificent plan of forming an emporium on each side of the Isthmus of Darien or Panama, for the trade of the opposite continents. According to his idea, the manufactures of Europe were to be sent to the Gulf of Darien, and thence conveyed by land across the ridge of mountains that intersect the isthmus, where they were to be exchanged for the produce of South America and of Asia; and thus, to use his own emphatic language, he would wrest the keys of the world from Spain. In order to attract encouragement and support, he proposed to render his settlement a free port,

and to banish all distinction of party, religion, or nation. But Scotland was at this time very poor; and Paterson went to London to procure subscriptions, which soon ran up to the amount of \$1,500,000. But alarm, first excited by the East India Company and the West India merchants, soon spread over the whole English nation. Even the Parliament addressed King William, in an address remarkable for narrow and illiberal views; and the king, who could ill afford to quarrel with both the English houses of Parliament, nor compromise himself at this juncture with Spain, replied to the address in terms which were interpreted as disfavorable to the scheme, and the English subscriptions were withdrawn. But Paterson himself was not to be easily intimidated; and Scotland, indignant at the opposition which the plan had met with in England, avowedly because it would be beneficial to the Scotch, immediately subscribed \$2,000,000, although at that time there was not above \$4,000,000 of cash in the kingdom. Only a little more than the half of the subscriptions, however, was ever paid up. Such was the national enthusiasm, that young women threw their little fortunes into the stock, and widows sold their jointures to get the command of money for the same purpose. Besides this sum, \$1,500,000 was subscribed at Hamburg, which, however, was withdrawn, in consequence of the threatening memorial presented by the English resident to the senate of that city. The Scotch, nevertheless, persisted in their scheme: five large vessels, laden with merchandise, military stores, and provisions, with a colony of 1,200 persons, sailed for the Isthmus of Darien, which they reached after a voyage of about four months.

The settlement was very judiciously formed at Acta, a place at an equal distance between Porto Bello and Cartagena. Here is a secure and capacious harbor, formed by a peninsula, which the colonists fortified and named Fort St. Andrew. To the settlement they gave the name of New Caledonia. Of the 1,200 persons who had embarked 300 were gentlemen, unaccustomed to labor, fatigue, or homely fare, and totally unacquainted with any of those arts which are indispensably necessary in a new colony. These consequently were of little use; and even the peasants, habituated to a cold climate, were unequal to the fatigue of clearing the ground under a burning tropical sun. In addition to these untoward circumstances, their provisions were either improper for the climate or soon exhausted. The cargoes of merchandise which they sent to the West India islands were not properly adapted for that market. The infant colony was attacked by the Spaniards, and proclamations were issued at Jamaica, Barbadoes, and in the American plantations, prohibiting all succor or access to the Scotch at Darien, on the pretense that their settlement there was an infringement of the alliance between England and Spain. For eight months the colony bore up against these accumulated misfortunes and persecutions; but at the end of this period those who survived were compelled, by disease and famine, to abandon their settlement and return to Europe.

Before this circumstance was known, two other expeditions sailed from Scotland; and the information of the abandonment of the first colony only served to arouse the Scotch nation to more determined perseverance in the plan.

When the second expedition arrived, they found the huts burned and the forts demolished; famine and disease assailed them; they were attacked by the Spaniards from Panama, these they repulsed; but a larger force coming from Cartagena obliged them to capitulate, on condition that they should embark with their effects for Europe; few, however, of these or the other two colonies survived to return to Scotland.

The people of Scotland were indignant at this utter and irremediable failure. They endeavored to extort from William an acknowledgment of the national right to Darien; and failing in this, they presented an address to him to assemble the Scotch Parliament; when it did assemble, a resolution to assert the national right to their colony was only prevented by adjournment, and ultimately by proroguing the Parliament; it was, however, soon necessary to reassemble and mollify it in order to get the supplies for the army; and when it did meet again, some very popular and spirited resolutions were adopted on this subject. The Scotch nation were never afterward thoroughly reconciled to King William, and even for many years subsequent to his death, the remembrance of the loss of Darien was preserved with resentment and regret. In this scheme many families were reduced to ruin, and few had escaped without the loss of a relative or friend. Paterson, on his passage home, after the ruin of the first colony, was seized with lunacy, from which, however, he recovered. He lived many years after, pitied, respected, and neglected. In order to pave the way for a better understanding between the two countries, the lords commissioners for England agreed in 1706 to purchase the shares of the particular members of the Darien Company. A full account of the Darien expedition is to be found in the second volume of Sir John Dalrymple's *'Memoirs of Great Britain and Ireland.'* The best recent authority on the subject is John Hill Burton (see his *'History of Scotland'* and his *'Darien Papers'*). See also Sir Walter Scott's *'Tales of a Grandfather'* for a most interesting but rather one-sided narrative.

**Da Rimini, Francesca**, frän-chēs'kā dā-rē'-mē-nē, an Italian lady of the 13th century, the daughter of Guido da Polenta of Ravenna. She was married to Giovanni Malatesta da Rimini, a cripple, but loved his brother Paolo. Giovanni surprised the lovers at one of their meetings, and killed them both (about 1285). Their story is told in Dante's *'Inferno,'* and is the subject of Leigh Hunt's poem, *'The Story of Rimini,'* and of the dramas, *'Francesca da Rimini,'* by D'Annunzio, and *'Paolo and Francesca,'* by Stephen Phillips.

**Darius, da-rī'ūs**, the name of several Persian kings, or, according to some writers, the royal title itself. Among the most distinguished individuals of this name are:

1. **DARIUS**, fourth king of Persia: d. 485 B.C. He joined the conspiracy against the False Smerdis, who had possessed himself of the Persian throne. After the conspirators had succeeded in getting rid of the usurper, they agreed to meet early the next morning, on horseback, and to appoint him king whose horse should neigh first after sunrise. The groom of Darius, apprised of this project, led his master's horse in the night with a mare to the appointed place, and, in consequence of this stratagem, the horse

## DARJEELING — DARK CONTINENT

of Darius neighed first the next morning. Darius was therefore saluted king, and the nation approved the choice. His reign was marked by many important events. The city of Babylon revolted, partly on account of burdensome impositions of tribute, and partly because the royal residence, under Cyrus, had been transferred thence to Susa. Darius besieged the city nearly two years without success, and was on the point of abandoning the siege when Zopyrus, one of his generals, by a heroic sacrifice, placed the city in his possession. After the subjection of Babylon Darius undertook an expedition, with an army of 700,000 men, against the Scythians on the Danube, who enticed him so far into their inhospitable country by their pretended flight, that he succeeded with difficulty in extricating himself and his army, after suffering great losses. Leaving a part of his forces under the command of Megabyzus in Thrace, to conquer that country and Macedonia, he returned with the remainder to Asia, to recruit at Sardis. In the year 501 B.C. a disturbance at Naxos, in which the Persians had taken part, occasioned a revolt of the Ionian cities, which the Athenians endeavored to promote, but which was suppressed by the capture and punishment of Miletus in 496. To revenge himself upon the Athenians, Darius sent Mardonius with an army, by the way of Thrace and Macedonia, against Greece, and prepared a fleet to make a descent upon its coasts. But his ships were scattered and destroyed by a storm in doubling Mount Athos, and the army was almost entirely cut to pieces by the Thracians. Darius, however, collected another army of 500,000 men, and fitted out a second fleet of 600 ships. Naxos was conquered, and Eretria, in Euboea, sacked. Thence the army under Datis and Artaphernes proceeded to Attica, and was led by Hippas to the plains of Marathon. The Athenians had in vain besought assistance from their neighbors, and were obliged to depend upon their own resources alone. They marched forth, 10,000 strong, under the command of Miltiades, to meet the Persian army, and animated by the reflection that they were fighting for freedom and their country, obtained a complete victory (490 B.C.). This prince did much to improve the internal administration of his kingdom. In the year 508 B.C. he sent his admiral, Scylax, to explore the river Indus, and he encouraged commerce and arts by useful institutions and laws.

2. **DARIUS II.**, king of Persia (surnamed Nothos, or the Bastard, by the Greeks): d. 404 B.C. He was an illegitimate son of Artaxerxes I. (Longimanus). He ascended the throne in 423, and suppressed several rebellions of his satraps; but Amyrtæus succeeded in maintaining himself in independent possession of Egypt, which had revolted in 414. His son Cyrus is familiar to us through Xenophon's 'Anabasis.'

3. **DARIUS III.**, king of Persia (surnamed Codomannus). He was the great-grandson of Darius II., and the 12th and last king of Persia. He ascended the throne 336 B.C., when the kingdom had been weakened by luxury and the tyranny of the satraps under his predecessors, and could not resist the attacks of a powerful invader. Such was Alexander of Macedon; and the army sent against him by Darius was totally routed on the banks of the Granicus, in Asia Minor. Darius then advanced with 400,000 soldiers, to the plains

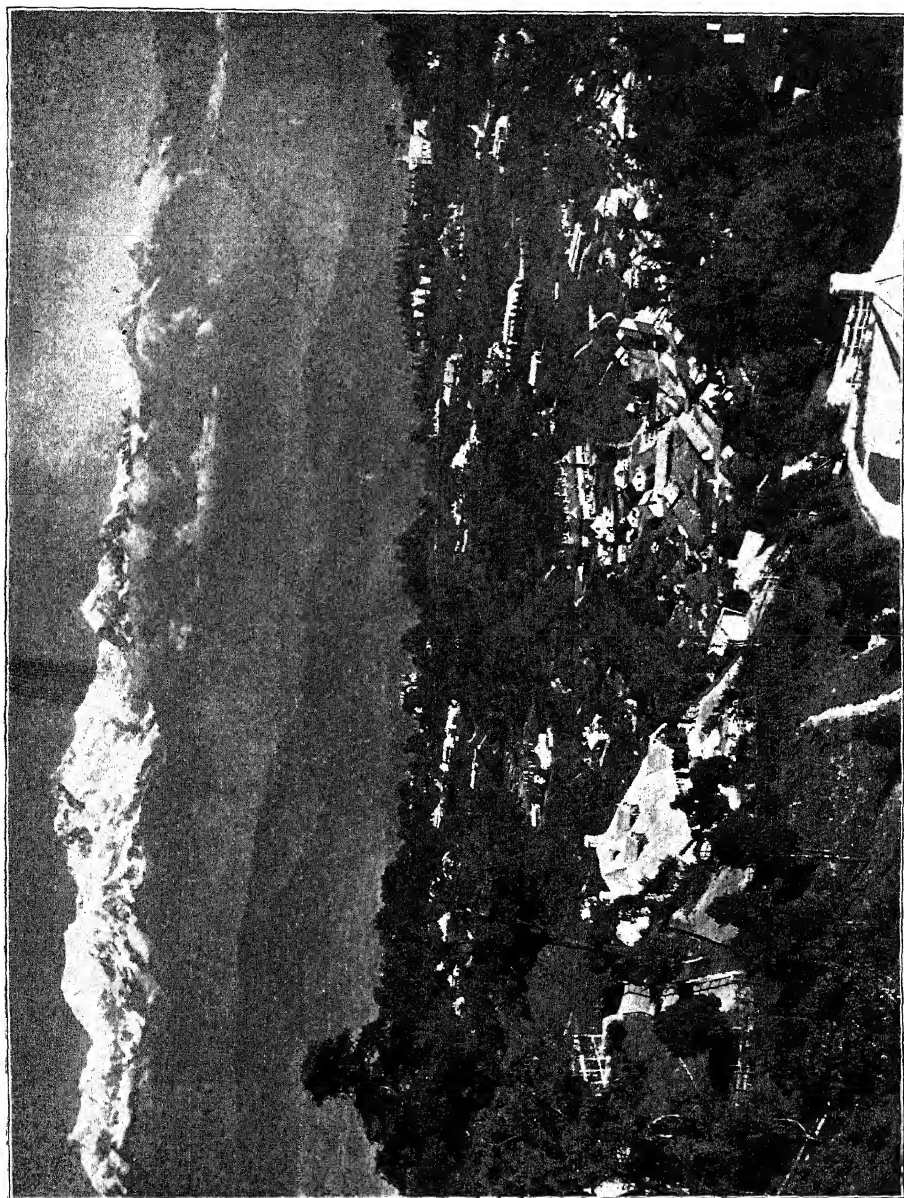
of Mesopotamia. The Grecian mercenaries advised him to await the enemy here, as the level country would enable him to draw out his outforces to advantage; but Darius hastened forward to meet Alexander in the mountainous Cilicia. Darius was a second time totally routed, near the Issus 333 B.C. He himself escaped, under cover of the night, to the mountains. His mother, his wife, and three of his children fell into the hands of the conqueror, who treated them with great generosity. Darius was so far from being discouraged by these defeats that he wrote a haughty letter to Alexander, in which he offered him a ransom for the prisoners, and invited him to a new engagement, or, if he did not choose that, granted him permission to retire into Macedonia. Alexander then laid siege to Tyre, on which Darius wrote him another letter, offering him not only the title of king, which he had before refused to do, but also 10,000 talents ransom, and all the countries of Asia as far as the Euphrates, together with his daughter, Statira, in marriage. These propositions, however, were unavailing. Alexander subjected Egypt, and the two armies met between Arbela and Gaugamela, and after a bloody engagement Darius was compelled to seek safety in flight (331 B.C.). Alexander took possession of his capital, Susa, captured Persepolis, and reduced all Persia. Darius fled to the northern provinces, where he was seized by Bessus, one of his satraps, and afterward murdered.

**Darjeeling**, dār-jēl'ing, **Darjiling**, or **Dorjiling** (the diamond thunderbolt land), (1) a district of India, in the extreme north of the province of Bengal; area 1,234 square miles. It lies on the southern slope of the Himalayas, and consists partly of mountain and valley, partly of a *terai* or marshy strip below the mountains, some of which are over 10,000 feet high. Coffee, cinchona, rice, and cotton are raised, and the cultivation of the tea-plant is rapidly extending; about 65,000 acres are now in tea plantations. Pop. (1891) 233,314. (2) The chief town in this district is Darjeeling, a celebrated sanatory station, and for several months of the year the residence of the lieutenant-governor and his staff. The Darjeeling & Himalayan Railroad connects it with Calcutta. Pop. 13,037.

**Dark Ages**, **The**, a period supposed to extend from the fall of the Roman empire, 475 A.D., to the revival of literature on the discovery of the Pandects at Amalfi in 1137. Not to draw the limits too finely, say 700 years (450 to 1150). The Middle Ages may be extended to about 1550, covering from 10 to 11 centuries.

**Dark and Bloody Ground**, **The**, a name frequently applied to the State of Kentucky. It is said to be a translation of the Indian words "Kain-tuk-ee," though some authorities claim that they signify "At the head of the river." The epithet was originally bestowed because the region was the scene of many sanguinary conflicts between the redmen of the northern and southern tribes. Later the constant feuds between white settlers and the aborigines rendered the phrase peculiarly appropriate to this locality.

**Dark Continent**, **The**, Africa, in allusion to the almost total ignorance concerning the people and geography of its interior which until quite recently prevailed in Europe and America. See AFRICA.



DARJEELING, INDIA, SHOWING THE HIMALAYA MOUNTAINS.



## DARK DAY — DARLING

**Dark Day**, a name frequently used in this country in connection with 12 May 1780, but applied also to days on which similar phenomena have been discerned. On the date mentioned the atmosphere in New England was so obscured as to cause in some places cessation from outdoor labor. Birds and domestic fowls acted as during an eclipse. The darkness began at 10 and lasted until night, causing a feeling of alarm by its unprecedented nature. There appears to have been an absence of clouds for the most part, though light rain occurred. Though known as the Black Friday of New England, the area covered by darkness also extended west of that section.

Two dark days are recorded as occurring in America earlier than the Black Friday, one in 1716 and another in 1762. The Dark Days of Canada were 16 Oct. 1785 and 3 July 1814. On the latter date the darkness extended over a tract estimated to be about 300 miles in length and 200 in breadth, in the region of the Saint Lawrence River and Gulf. There were showers of sand and very dark ashes and the atmosphere was of a deep yellow color. The characteristic features seemed to point to volcanic action as an origin rather than to forest fires. These two causes have in recent years received much attention in their relation to the obscuring and tinting of the atmosphere over immense areas. The smoke from great forest fires in the northwestern States and in Canada was in 1881 carried south or southeast to almost incredible distances and in June 1903 extensive fires in the forests of New England and of the Adirondacks caused a yellowish haze that extended far from its source. After the volcanic eruptions of Mount Soufrière and Mount Pelée in May 1902 vast quantities of volcanic dust were borne seaward, more or less obscuring the daylight by their persistence in the atmosphere. The volcanic dust from Krakatoa is believed to have encircled the entire earth and to have affected the color of the atmosphere for months. In countries situated like Egypt a marked obscuration of daylight may often be accounted for by the fine sand brought by winds from the desert.

**Dark Horse**, a phrase used in racing concerning a horse when its power of performance or chances of success are not generally known. The expression has been transferred to fields of human competition, and is frequently used in politics, especially in reference to candidates for nomination in a convention, when they are unexpectedly brought forward or draw a following that had not been anticipated.

**Darke, William**, American soldier: b. Pennsylvania 1736; d. Jefferson County, Va., 26 Nov. 1801. At 19 he served with the Virginians in the battle of Braddock's defeat, and afterward in the war of the American Revolution. At Saint Clair's defeat he commanded the left wing of the army, and made two gallant and successful charges with the bayonet, in the second of which his youngest son, Capt. Joseph Darke, fell mortally wounded (4 Nov. 1791). His father paused but a moment over him, and rushed with redoubled energy into the conflict. He was repeatedly a member of the Virginia legislature, and, as member of the convention of 1788, voted for the Federal Constitution.

**Darlaston**, England, town in Staffordshire, included in the parliamentary borough of Wednesbury. It is an irregular, straggling place, engaged in the manufacture of iron for bridges, roofing, and railroads, and gunlocks, bolts, bars, screws, etc. Pop. (1901) 15,391.

**Darley, Felix Octavius Carr**, American artist: b. Philadelphia, Pa., 23 June 1822; d. Claymont, Del., 27 March 1888. His illustrations of literary masterpieces gave pleasure to thousands, and made him famous. His best work comprises his drawings to accompany the text of 'Rip Van Winkle'; 'Sleepy Hollow'; 'Courtship of Miles Standish'; 'Scarlet Letter'; 'Evangeline'; the novels of Cooper, Dickens, and others, besides many special pictures. His book 'Sketches Abroad with Pen and Pencil' (1868) is well known.

**Darley, George**, English poet: b. Dublin 1785; d. London 1849. He was graduated at Trinity College, Dublin, in 1811, went to London in 1825, and became attached to the 'Literary Gazette' and 'Athenæum' journals, in which his criticisms of poetry and the fine arts made him well known. He is the author of the 'Labors of Idleness'; 'Sylvia' (1822), and miscellaneous works of a mingled philosophical and poetic character.

**Darling, Flora Adams**, American novelist: b. Lancaster, N. H., 1840. She married Edward Darling, a Confederate officer, killed in the Civil War. She was one of the founders of the society of Daughters of the Revolution and has been prominent in that and other patriotic organizations. She has published: 'A Wayward, Winning Woman' (1890); 'Was it a Just Verdict?' (1890); 'The Bourbon Lily'; 'Mrs. Darling's Letters, or Memories of the War' (1894); 'A Social Diplomat' (1898); 'History D. A. R. and D. R. Societies of Patriotic Organizations' (1901); 'The Senator's Daughter,' etc.

**Darling, Grace Horsley**, English heroine: b. Bamborough, England, 24 Nov. 1815; d. 20 Oct. 1842. She was the daughter of the keeper of the Longstone Lighthouse. The event which made her famous occurred on 6 Sept. 1838. The steamer Forfarshire was wrecked near the lighthouse, and at daylight William Darling descried the wreck from Longstone, but accustomed to scenes of danger as he was, shrank from attempting to reach the wreck through a boiling sea in a boat. His daughter, who could see, by the aid of a glass, the sufferers clinging to the wreck, implored him to let her accompany him in the endeavor to relieve them. At last he consented; and father and daughter reached the wreck, and found nine sufferers, whom they succeeded in bringing to the lighthouse. The news of the heroic deed soon spread, and a purse of \$3,500 was quickly subscribed and presented to the brave girl.

**Darling** (so called from a governor of New South Wales), a name of several applications in Australia. (1) The Darling River, a river rising in the northeast of New South Wales, is formed by the junction of several streams, and flows in a southwesterly and southerly direction till it joins the Murray at Wentworth. (2) Darling district is a pastoral district about 50,000 square miles in extent, in the southwest of New South Wales, and watered



## DARLINGTON — DARNLEY

by the Darling and the Murray. (3) The Darling Downs are a rich table-land west of Brisbane in Queensland, forming excellent pasture and arable land. It is well watered, and measures about 6,000 square miles. (4) The Darling Range, granite mountains in western Australia, running in a northerly direction parallel with the coast from Point D'Entrecasteaux for nearly 300 miles. Its highest peaks do not exceed 1,500 feet in height.

**Darlington, William**, American botanist: b. Birmingham, Pa., 28 April 1782; d. Westchester, Pa., 23 April 1863. He was a soldier in the War of 1812, and a member of Congress 1815-17, and 1819-23. He published a descriptive catalogue of plants in Pennsylvania: 'Flora Cestricea' (1837-53); 'Mutual Influence of Habits and Disease' (1804); 'Agricultural Botany' (1847); and in 1853 a genus of pitcher-plant found in California was named in his honor, *Darlingtonia Californica*.

**Darlington, England**, a municipal and parliamentary borough in Durham County. It is well built, chiefly of brick, and nearly in the form of a square, and has among its public buildings an ancient Gothic church with a lofty spire, founded in 1160, restored in 1865; corporation buildings, with a handsome clock-tower; market-house, hospital, an infirmary, a technical college, mechanics' institute and library, a grammar-school, a girls' training college, etc. A free library was established in 1885. The woolen manufacture is carried on to a considerable extent, and there are large manufactories of iron, steel, locomotives, materials for bridges and railroads. The town is on the Stockton & Darlington Railroad (now part of the North Eastern system) which was the first line in England on which locomotive steam-engines were used. Pop. (1901) 44,496.

**Darlington, S. C.**, town, county-seat of Darlington County, on the Atlantic Coast Line Railroad, about 80 miles northeast of Columbia. It is in an agricultural region, and is a trade centre for tobacco, cotton, corn, and other products. The manufactures are chiefly cotton goods, tobacco, and fertilizers. Pop. (1902) 3,652.

**Darlingtonia**, a genus of pitcher-plants, belonging to the order *Sarraceniacæ* (sarraceniads). The *D. californica* grows in the northern part of California, chiefly in the district around Mount Shasta. It is found in boggy places on the slopes of mountains. It entraps insects, which are attracted to the curious pitcher or hood at the extremity of the tubular leaves; and, once inside, are prevented by the fine hairs which point downward from returning. Sometimes the leaf-stems at their base are filled to the depth of four or five inches with insect remains. The larva of a small moth *Xanthoptera semicroca*, preys on the plant, and that of a dipterous insect, *Sarcophaga sarraceniae*, feeds on the dead insects which it encloses. See CARNIVOROUS PLANTS.

**Darmesteter, Agnes Mary Frances Robinson**, English poet: b. Leamington, England, 27 Feb. 1857. She has attained great proficiency in Greek studies, her verse showing the influence of Hellenic literature. In 1888 she married James Darmesteter (q.v.), the Orientalist, who died in 1894, and in 1901 she married Emile Duclaux, director of the Pasteur Institute in

Paris. Her writings include: 'A Handful of Honeysuckle' (1878); 'The Crowned Hippolytus, from Euripides' (1881); 'Arden,' a novel (1883); 'Emily Brontë' (1883); 'The New Arcadia and Other Poems' (1884); 'Margaret of Angoulême, Queen of Navarre' (1885); 'An Italian Garden' (1886); 'The End of the Middle Ages: Essays and Questions in History' (1888); 'Songs, Ballads and a Garden Play' (1888); 'Lyrics' (1891); 'Retrospect' (1893); 'Life of Renan' (1897); 'A Mediæval Garland' (1897); 'Collected Poems' (1901); and in French, 'Marguerites du Temps Passé' (1892); 'Froissart' (1897); 'Grands Ecrivains d'Outremanche' (1901).

**Darmesteter, dār - mē - stē - tār, James**, French Orientalist: b. Château-Salins, 28 March 1849; d. Maisons-Laffitte, near Paris, 19 Oct. 1894. Besides works of strict scholarship on the Oriental literatures, as 'Ormazd and Ahri-man' (1877); 'Iranian Studies' (1883); 'Origins of Persian Poetry,' he wrote many essays on miscellaneous subjects. There is an English translation of some of his 'Selected Essays.' He translated with Mills the 'Zend-Avesta' for the 'Sacred Books of the East' series, published by the University of Oxford and edited by Max Müller.

**Darmstadt, dārm'stāt, Germany**, capital of the Grand duchy of Hesse, near the Darm River, 15 miles south of Frankfurt. It consists of an old and a new town. The former, which is the business part of the town, is very poorly built; the houses are old, and the streets narrow and gloomy. The new town is laid out with great regularity, and has handsome squares and houses. Among the remarkable buildings are the old palace (with a library of 500,000 volumes and 4,000 MSS., a picture gallery, and a rich museum of natural history), the Roman Catholic Church, patterned after the Pantheon, the Stadtkirche, and the Rathaus, or town-hall, built in 1580. Darmstadt has some iron foundries, breweries, and other manufactures, and its industries are increasing, but it depends more upon the residence of the court than upon either trade or manufactures. It owns its own electric and gas plants, and its schools and charitable institutions are numerous for its population. Justus von Liebig, the scientist, was born here in 1803. Pop. (1900) 72,381.

**Dar'nel**, the popular name for *Lolium tenuilentum*, which some suppose to be the *Infelix lolium* of Virgil and the *Zizania* (tarcs) of Scripture. It is believed by the ancients to be poisonous and narcotic. It is common in waste places and fields in America from New Brunswick to Georgia and northward to Michigan. It is remarkably abundant on the Pacific Coast and is generally a troublesome weed. It has been naturalized from Europe.

**Darnley, Henry Stuart, Lord**, husband of the Scottish queen, Mary Stuart: b. England 1546; d. Edinburgh 10 Feb. 1567. His father, the Earl of Lennox, was descended from a branch of the house of Stuart; his mother, Margaret Douglas, was the daughter of Margaret of England, sister of Henry VIII. Darnley, though devoid of real merit, had, by his personal attractions, won Mary's heart, but it was an unfortunate match; and ere long gave rise first to coolness, then to open quarrel, and finally to deadly hate. Darnley thought, or affected to



think, that her regard for David Rizzio was of a kind which no husband ought to tolerate, and leagued with a body of conspirators, who, on 9 March 1566 dragged Rizzio from the queen's presence, and murdered him under circumstances of horrid barbarity. About the end of that year Darnley was seized with smallpox. In January Mary had him conveyed to an isolated house called Kirk of Field, which stood at some distance from Holyrood. This dwelling, which belonged to a retainer of Bothwell's, the rapidly rising favorite, was blown into the air with gunpowder. The dead bodies of the king and his page were found in a field at a distance of 80 yards from the house, quite free from any mark which such an explosion would cause. Previous to this tragedy a son had been born of the marriage, who afterward united the Scotch and English crowns under the name and title of James I. of England and VI. of Scotland.

**Darrow, Clarence S.**, American lawyer: b. Kinsman, Ohio, 18 April 1857. He was admitted to the bar in 1875, and for some time filled the position of attorney for the Northwestern Railroad Company. He has been very prominent in legal practice, and been retained in many cases against monopoly, as for example in the case against the Gas Trust in Chicago. He is an active politician, being identified with the Independent Democrats. He has written a volume of essays, entitled 'The Persian Pearl,' and many brochures on topics relating to political economy and the social structure.

**Dart**, a javelin, a short missile weapon thrown by the hand, or impelled by the breath, through a tube. Dart-heads are usually made of iron, but among savage nations flints, sea-shells, fish-bones, and other hard substances have been employed; and among some of the aboriginal inhabitants of the United States and Africa, the dart was merely a sharp-pointed stick, the end of which was carbonized by fire. The weapon is always very simple in its construction, and is usually from three to five feet long.

**Darter**, a name given to water birds of a small family (*Plotidae*), found in the southern United States, in Africa, Asia, and Australia. The American species (*Anhinga anhinga*), also called the snake-bird and water-turkey, is especially common in Florida, and extends northward to North Carolina and Illinois. In appearance and habits the darter resembles the cormorant, especially in the structure of the feet, wings, and tail; the bill and neck are like those of the heron, the neck, owing to a peculiar anatomical mechanism, being remarkably flexible. The general color of the body is dark glossy green with silvery gray markings; wings and tail, bluish-black. The tail is rather long and consists of 12 narrowly wedge-shaped quills. Their haunts are in low swampy localities, by the side of murky streams. They generally perch on trees whose branches dip into the water. They are the best fresh-water divers known, and drop into the water with such surprising skill that the large body makes scarcely any noise, and but little ripple on entering the water. When swimming, its body is submerged, and the only part visible is the long neck, writhing about like an aquatic serpent, from which peculiarity its name of snake-bird. Its food consists of small fish, shrimps, young reptiles, leeches, etc. The quantity of fish it can

consume is enormous; but like other bird feeding on fish and flesh, it can remain several days without food with impunity. It captures fish, not by diving upon them from above, but by pursuing them under water and spearing them with its closed beak. A bulky nest of sticks, roots, etc., is placed in a tree and receives three or four white chalky eggs.

**Darters**, small fresh-water fishes forming a sub-family of the *Percidæ* (q.v.), from the typical members of which they are distinguished by having the pseudobranchiæ (opercular gills) imperfect or absent, the margin of the gill-cover smooth, the skull less perfectly ossified, etc. They have been described as perches reduced in size and compacted. The *Etheostomatinae* are peculiar to North America, where 15 genera and about 80 species occur, mostly in rocky rills and clear mountain brooks too small to be occupied by other fishes. They are among the smallest of fishes, some of the species being less than two inches, and the largest—the so-called log-perch (*Percina caprodes*) of the Great Lake region and Mississippi Valley, only six to eight inches long. The typical and largest genus is *Etheostoma*.

The darters spend most of their time resting on their fins on the bottom, hiding beneath stones, or burying themselves in the sand, leaving only the eyes uncovered. Owing to the protective resemblance of their markings to the bottom, they are difficult to distinguish. When disturbed, most of the species dart for a short distance with the greatest rapidity, and again settle on the bottom in a quiescent state. These little fishes are among the most interesting inhabitants of our fresh waters, and a valuable account of their habits will be found in a paper by Jordan and Copeland in the 'American Naturalist' for 1876.

**Dartford**, England, a market-town of Kent, in the narrow valley of the Darent River, two miles above its entrance into the Thames, and 17 miles east southeast of London. Edward III. here founded an Augustinian nunnery (1355); St. Edmund's chantry was a great place of pilgrimage; and at Dartford, Wat Tyler began his rebellion (1381). Spielman built here the first paper-mill in England (1590). There is considerable manufacturing, chief of which are the cotton goods, powder, paper, and corn meal, iron and iron products, oil, and chemicals. Pop. (1902) 18,965.

**Dartmoor**, an extensive, rugged, mountainous tract in England, in the western part of Devonshire, often called the "Forest of Dartmoor," but at present having no appearance of a forest, except what is afforded by some dwarf oaks, intermixed with ash and willow; reaching from Brent south to Oakhampton north, 22 miles, with a breadth of about 20 miles, and occupying from 130,000 to 150,000 acres. In the centre of the moor there is an extensive swamp in which the rivers Dart, Teign, Taw, Yealm, Erme, and a great number of smaller streams have their source. Cattle and sheep are fed on the coarse grass during the summer months. In the winter the storms from the Atlantic sweep over it, and it would be difficult to imagine a more desolate-looking place. Several of the rugged granite hills (here called "tors") are of considerable height, Yes Tor rising 2,050 feet above the plain. The district is noted as

## DARTMOOR MASSACRE — DARTMOUTH COLLEGE

being the site of a prison built in 1809 for the custody of the French prisoners of war at a cost of \$635,000. At one time it contained 10,000 inmates. It covers an area of 30 acres, and is now fitted up for the reception of convicts. Experiments made in cultivating the moor by convict labor have turned out successfully. The large kaolin-works and a meteorological observatory are at Lee Moor. Dartmoor offers considerable attraction to the tourist and naturalist. Druidical and other aboriginal remains may be traced, especially Gray Wethers, which is thought to have been a Druidical temple. The dolmens, cairns, and other indications of an ancient town, are found at Drewsteignton. Since 1337 Dartmoor has been annexed to the duchy of Cornwall.

**Dartmoor Massacre, The,** 6 April 1815. During the War of 1812 the American naval prisoners of the British, with impressed American seamen discharged from British vessels, were collected at Dartmoor military prison. On 31 March 1815 they numbered 5,693, including about 1,000 negroes. They had heard of the Peace of Ghent, 24 Dec. 1814, and expected immediate release; but the British government refused to let them go on parole, or take any steps till the treaty was ratified by the Senate, 17 Feb. 1815. It took several weeks for the American agent to secure ships for their transportation home, and the men grew very impatient. On 4 April the dishonest food contractor attempted to work off some damaged hardtack on them in place of soft bread, and was forced to yield by their insurrection, and the commandant, Capt. T. G. Shortland, suspected them of a design to break jail. This was the reverse of truth in general, as they would lose their chance of going on the carts; but a few had made reckless threats of the sort, and the commandant was very uneasy. About 6 P.M. of the 6th he discovered a hole from one of the five prisons to the barrack yard near the gun-racks. Others had been begun, apparently for pastime. Some prisoners were outside the guard railing noisily pelted each other with turf, and many more near the breach (and the gambling tables), though the signal for return to prisons had sounded: altogether he was convinced of a plot, and rang the alarm bell to collect the officers and have the men ready. This luckless precaution brought back a crowd just going to quarters; just then a prisoner broke a gate-chain with an iron bar, and a number pressed through to the prison market square; and after attempts at persuasion, Shortland ordered a charge which drove part of the prisoners in. Those near the gate, however, hooted and taunted the soldiery, who fired a volley over their heads; the crowd yelled louder and threw stones, and the soldiers, probably without orders, fired a direct volley which killed and wounded a large number. Then, losing their heads, they followed the throng of prisoners struggling frantically to get within the prison doors, shooting them down as they went, some even going up to the doors and firing in; while others ran up to the walls and fired into the fleeing knots below. Finally the captain, a lieutenant, and the hospital surgeon (the other officers being at dinner) succeeded in stopping the murder and caring for the wounded — about 60, 30 seriously, besides 7 killed outright. The affair was examined by a

joint commission, Charles King for the United States and F. S. Larpent for Great Britain, who agreed in exonerating Shortland, justifying the first firing, blaming the subsequent, and pronouncing the culprits undiscoverable. The British government provided for the families of the killed, pensioned the disabled, and promoted Shortland. Consult: Charles Andrews, 'The Prisoners' Memoirs; or Dartmoor Prison'; Cobb, 'A Green Hand's First Cruise, Together with Five Months in Dartmoor.'

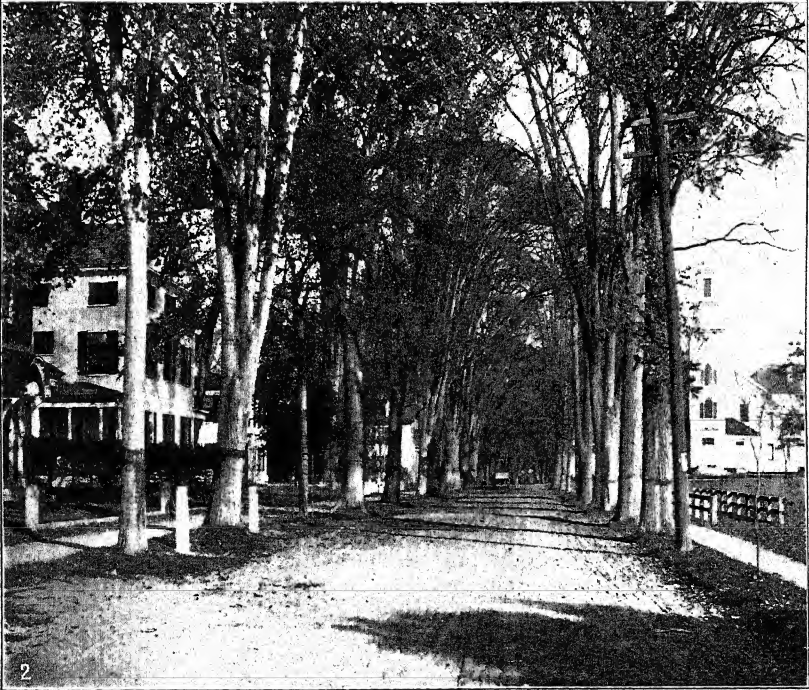
**Dart Moth,** a name applied to the genus *Agrotis*, a night-flying moth of destructive habits, the caterpillar of which is widely known as the cutworm. A European species is the winter dart moth which destroys wheat. The American group includes several species, most of which appear about midsummer. The caterpillars hide in the ground during the day, and at night come up to feed on the tender shoots of cabbage, corn, and other garden plants, which they usually cut off close to the ground. A recently discovered species, *A. Cochranii*, is a climbing cutworm, which destroys the leaves of apple, cherry, pear, and peach trees, and of grapes.

**Dartmouth,** därt'múth, Canada, town of Halifax County, Nova Scotia; connected by ferries with the city of Halifax of which it is practically a suburb. The chief manufactures are iron foundries, a sugar-refinery, tanneries, rope-works, and flour-mills. Fort Clarence is at the entrance of the eastern passage which leads to the town. In 1749 the town was founded, but two years after it was destroyed by Indians. Pop. (1902) 4,859.

**Dartmouth,** England, a seaport and municipal borough in the south of Devonshire; 3.2 miles south by west of Exeter. It is built in picturesque terraces on a steep slope 300 to 400 feet high, on the estuary of the river Dart, at a short distance from the sea. The streets are narrow, and many of the houses very old, with overhanging stories, projecting gables, and wood-carvings. St. Saviour's Church (1372) has a richly sculptured, painted, and gilt stone pulpit, and a beautifully carved rood-loft. A battery, and the remains of a castle built during the reign of Henry VII., stand at the entrance to the harbor. Sir Humphrey Gilbert was born at Greenway, on the opposite side of the Dart. Pop. (1901) 6,700.

**Dartmouth College,** a seat of learning in Hanover, N. H., which received its charter in 1769, and opened its doors the following year under the presidency of Eleazer Wheelock, D.D. It grew out of an earlier school established by Eleazer Wheelock in Lebanon, Conn., and designed for the education of Indian children. The idea of this school had been suggested to him by his success in educating a young Mohegan Indian, Samson Occom, who became a remarkable preacher. Other pupils from the Delaware tribe were afterwards received, and the school became an object of public attention and interest. In 1754, a farmer named Joshua Moor gave a house and two acres of land for the purposes of the institution, which was from this time known as Moor's Indian charity school. Occom, accompanied by the Rev. Nathaniel Whitaker, visited England to collect funds; a sum of about \$50,000 was subscribed, and a board of trustees was there organized, of which Lord Dartmouth,

DARTMOUTH COLLEGE.



1. Wilson Library.

2. Faculty Avenue.



## DARTMOUTH COLLEGE CASE

one of the subscribers, was made president. The school was named Dartmouth, in honor of this generous donor. The school was so much resorted to by the native tribes that Dr. Wheelock determined to transfer to some place near to them. Many proffers of situations were extended to him, but he selected the town of Hanover, on the Connecticut River, in the western part of the state of New Hampshire, and grants of about 44,000 acres of land were made to him. The institution was chartered by Gov. Wentworth under the name of a college, with all the privileges and immunities of any university within the British realm. Moor's school soon afterward obtained an independent charter, and still remains as an academical or preparatory department. In 1770 Dr. Wheelock removed his family and school, consisting of 18 whites and 6 Indians, from Lebanon to the wilderness of Hanover, where the whole colony lived in log huts. In 1771 the first class of four students was graduated. President Wheelock retained his office till his death in 1779, and was succeeded by his son, John Wheelock, who in 1782 was sent by the trustees to Europe to promote the interests of the college; and through introductions by Gen. Washington, Dr. Franklin, and John Adams, he obtained considerable sums of money, philosophical instruments, and other valuable donations. William, Prince of Orange, was one of the donors. Wheelock returned in 1784, and after a presidency of 36 years, was removed from the office by the trustees, in 1815. This act, which was occasioned chiefly by a local religious controversy, led to a conflict with the legislature of the State; that body claimed the right to amend a charter of which it was the guardian, and in 1816 passed acts creating a new corporation in which the property was vested, and changing the title of the college to Dartmouth university. The old trustees began a suit for the recovery of the college property. (See DARTMOUTH COLLEGE CASE.) Upon the trustees regaining control, Wheelock was raised to the presidency of the university, in February 1817, but died within two months. He was succeeded by William Allen, D.D., who retained the office until the "College Case" was decided (1819).

Dartmouth College still remains an institution for men only. It comprises besides the regular classical departments; the Medical School founded in 1798; the "Chandler School of Science," established in 1851, by the trustees, on the receipt of a bequest of \$50,000, from Abiel Chandler, who left it to them in trust "for the establishment and support of a permanent department or school of instruction in the college, in the practical and useful arts of life." The course in this school, leading to the degree of bachelor of science, covers four years, and includes a course in general science, political science, modern languages, mathematics, and history. Another department is "The Thayer School of Civil Engineering," founded in 1867, by Sylvanus Thayer, a graduate of Dartmouth. This is a graduate school, comprising a two years' course in civil engineering. The government of this school is vested in a board of overseers, consisting of the president of Dartmouth College, with four officers of the engineer corps of the United States army, active or retired. The report of the college for 1902 gives the following statistics: Professors, 66; number of stu-

dents, 787; volumes in library, 85,000; and value of property, including endowments, \$3,200,000.

**Dartmouth College Case, The.** The Dartmouth College Case is the name by which is commonly known the action entitled Trustees of Dartmouth College *v.* Woodward, which is reported in volume four of Wheaton's United States Supreme Court reports. Perhaps no decision ever rendered in any tribunal has attracted more attention or exerted a greater influence over the legislative and judicial history of our land than has the decision in this case, which arose as follows:

In the year 1769 the Reverend Eleazar Wheelock, aided financially and politically by friends in England and America, conspicuous among whom was the Earl of Dartmouth, and with the assistance of the Province of New Hampshire, given in the form of extensive land grants, founded Dartmouth College under a charter from King George III. of England. This charter vested the control of the institution in a board of trustees, who were designated by Mr. Wheelock to manage the same, and under the management of those trustees so incorporated and their successors the college grew and prospered until the year 1815, when the State legislature passed an act amending its charter by which they curtailed the power of its trustees, changed its name to Dartmouth University and made it a State institution subject to State control. For protection against this infringement of their powers, the trustees had recourse to the courts in the now famous case above named.

In the State tribunals the decision went against the college trustees and an appeal was taken to the Supreme Court of the United States, the appeal being based upon the theory that the charter granting the control of the college to the trustees was a contract, that under Section X. of Article I of the Federal Constitution no State can pass an act impairing the obligation of any contract, and that the said act of the New Hampshire Legislature violated the contract of the charter of Dartmouth College.

It should be remembered that in 1819 when the case came up for final hearing, the popular views of the scope and effect of the National Constitution were far from harmonious. All then regarded that instrument as the greatest existing governmental compact, but the Republican party then in power demanded that it be so strictly construed as to preserve unimpaired the rights and powers of the individual States. On the other hand, there then presided over the Federal Supreme Bench, in the person of John Marshall, one of the "midnight appointees" of John Adams, the last President of that Federalist party which demanded so liberal a construction of the instrument as to give the country a strong national government. Of the section of the Constitution invoked, we may safely say with Ordronaux that "Drafted at a time when commerce was in its infancy; when public credit was depreciated to the lowest ebb; and confidence in monetary transactions almost destroyed, it was manifestly introduced as a barrier against the tide of repudiation which threatened to overwhelm both public and private credit." The framers of the Constitution never intended that clause to be given the interpretation urged in this case. But the case was up before a court

## DARTMOUTH COLLEGE CASE

presided over by the jurist who has been truthfully said to have "found the Constitution a skeleton and clothed it with flesh and blood." Therefore, when it was clearly shown, as it was in the celebrated argument of Daniel Webster for the college trustees, that this case came fairly within the provisions of that section, in principle, the court, guided by John Marshall, held that the act of the New Hampshire Legislature was void because it impaired the obligation of a contract. Justice Duvall alone dissented.

This decision has perhaps been more severely criticised and has perhaps given rise to more strenuous efforts to escape its consequences than has any other decision of the tribunal which rendered it, and the reasons are obvious. While it gave assurance that capital invested in chartered business and charitable ventures would be forever protected from legislative interference, it also invited political corruption by saying in effect to promoters of corporations that the courts would protect them in the possession of every concession or right which they beguiled from pliant legislative bodies. It made possible the mechanical and industrial achievements of the 19th century in this country, but it also made profitable the limitless corruption which has attended those achievements and which has frequently, by virtue of this decision, stripped the government of very important powers.

But the correctness of a judicial decision is not to be gauged by its influence for weal or woe. Rather should that be determined by its conformity to the Constitution, the statutes and the judicial precedents upon which it rests and the approval given it by later decisions. Judged by this test we must hold that Marshall and his colleagues decided well in the Dartmouth College Case. The Supreme Court of the United States had early laid down the rule that there are certain vital principles of republican government which will overrule a flagrant and apparent abuse of legislative power. It had in the year 1810 declared a law granting land to private companies to be in effect a contract which could not be so repealed as to impair the obligation of that contract. If the passage of the law were procured by fraud the court there doubted its power to declare it void for those reasons, but if that power existed it could be exercised only under those rules of law and equity which govern private transactions. Two years later there came before the same court a case involving a somewhat similar question. The State of New Jersey had traded land with an Indian tribe and had, by legislative enactment, provided that the Indians should forever hold the lands received by them free from taxation. With the consent of the State they sold their lands and, the question being properly presented, the court held that the law granting the exemption was a contract, that the exemption ran with the land and that the purchasers from the Indians enjoyed the same exemption.

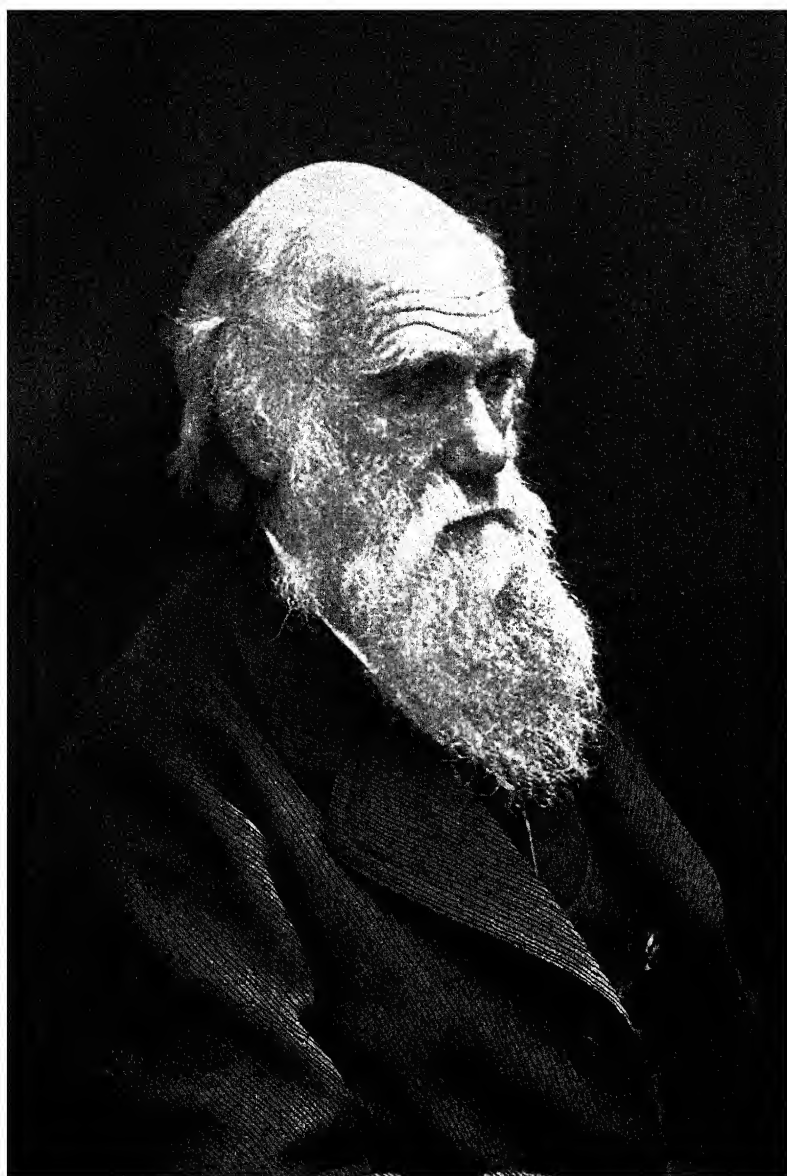
By the decision in the Dartmouth College Case the rules laid down in the foregoing cases were followed and their application extended to contracts in charters of incorporation, but their force when so applied had already been limited by another line of decisions. In 1804 Chief Justice Marshall, speaking for the court, had said that the charter gives to a corporation all of the powers it possesses and no powers not

granted can be exercised. A little later he had decided that there is a difference between a grant of corporate existence and a grant of peculiar remedies. The first is general. The second can only be exercised in those courts which the power bestowing the privilege can regulate. Moreover, as the bank charter involved in that case contained a clause making it a felony to counterfeit its notes, the court believed it to be a public act and subject to repeal by succeeding legislatures. And in the year 1819 the same court had decided that the right to use a peculiar form of attachment granted in its charter to a bank could be taken away at any time because "The forms of administering justice and the duties and powers of the courts as incident to the exercise of a branch of the sovereign power must ever be subject to the legislative will and the power over them is inalienable so as to bind subsequent legislatures."

It is thus made fully apparent that the Dartmouth College Case decided only that if a legislative grant, whether made in the form of a charter of incorporation or in any other form, conveyed to private citizens that which the legislature had power to contract away, the grant so made was a contract and no succeeding legislature could rescind the same without following the same rules which govern the rescission of private contracts. But if there is any doubt that such was the understanding of the chief justice who wrote the opinion of the court in that case, the same will be removed by a consideration of certain later decisions in which he participated. In the year 1821 the court over which he presided decided that Congress had power to incorporate a lottery to do business beyond the limits of the District of Columbia, yet, where no mention was made thereof in the charter, it would not be presumed that Congress had done so and had thereby deprived the States of their power to regulate lotteries by preventing the sale of tickets within their boundaries. In the same year the same court decided that a town government cannot contract away its legislative power. And in the case of *Providence Bank v. Billings*, the court presided over by Marshall decided that while a State might, through its legislature, grant immunity from taxation, it could not be presumed to have done so, and that, in the absence of any agreement to the contrary, it might tax to death a franchise which it had itself granted.

But the effect of the Dartmouth College decision was not fully understood at the time of its rendition and the States eagerly availed themselves of a suggestion found in the decision itself to the effect that if they wished the right to amend, alter or repeal charters granted by them they must expressly reserve that power. Such a reservation, whether expressed in the charter itself, the constitution or the general laws of the State, has been held to have the effect of "placing the State legislature back on the same platform of power and control over the charter containing it, as it would have occupied had the constitutional restriction never existed." Yet the later decisions hold that this reserve power must be reasonably exercised. The alterations must be made in good faith and consistent with the objects and scope of the act of incorporation. Sheer oppression and fraud cannot be inflicted under the guise of amendment or alteration. This power cannot be so





CHARLES DARWIN.





employed as to defeat or substantially impair the object of the grant or any right which has become vested under it. Where this power has been reserved, a State may tax property which it has forever exempted from taxation, but the taxes must not be greater than those imposed upon other property. It can regulate the charges of common carriers, but no such legislation must amount to the taking of private property for public purposes without due process of law. We thus see that not only was the Dartmouth College decision as moderate as any of the later cases which have been said to have practically overruled it, but that even where reservations in charters have obviated the effect of that decision the later courts have reached a similar conclusion by a different chain of logic.

*Bibliography.*—Cook, 'The Corporation Problem'; Cooley, 'Constitutional Limitations'; Curtis, 'Life of Daniel Webster'; Hitchcock, 'Constitutional Development of the United States as Influenced by Chief Justice Marshall'; Morawetz, 'Private Corporations'; Shirley, 'The Dartmouth College Causes and the Supreme Court'; Story, 'On the Constitution'; Tiedeman, 'The Unwritten Constitution of the United States'; Von Holst, 'Constitutional Law of the United States.'

S. V. WRIGHT,  
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**Darton, Nelson Horatio**, American geologist: b. Brooklyn, N. Y., 17 Dec. 1865. He received a common school education and became a chemist and later a geologist. He has made many geological surveys for the United States Government. His chief work is 'Catalogue of North American Geology, 1732-1891.' Since 1890 he has been connected with the United States Geological Survey.

**D'Arusmont, dā-rūs-môn, Madame Frances** (maiden name FANNY WRIGHT), American philanthropist and author: b. Dundee, Scotland, 6 Sept. 1795; d. Cincinnati, Ohio. She married M. d'Arusmont in 1838, but the marriage was not a congenial one and her later years were spent in the United States. She lectured extensively on social, religious, and political questions. Among her works are: 'Views on Society and Manners in America'; 'Altorf,' a tragedy (1819); 'Lectures on Free Inquiry' (1836).

**Darwar, dār'wār, or Dharwar, India**, a town and fortress in the district of Bombay, 285 miles southeast of Bombay city, capital of a district of the same name. The town exports cotton and rice. It is connected by railroad with Goa, the Portuguese colony, and with other places. Pop. (1901) 31,279. The district of Darwar has an area of 4,603 square miles. The soil and climate are well adapted to the cultivation of cotton. Pop. 1,051,314.

**Dar'wen** (till 1889 OVER DARWEN), England, a municipal borough in the county of Lancaster. It has among its public buildings numerous churches and chapels, a market-house, public baths, free library, theatre, technical-school, hospitals, etc. The staple manufacture is cotton. The other manufactures are paper, iron castings, machinery, earthenware, etc. The water, electric, and gas plants are owned by the city. Pop. (1901) 38,211.

**Darwin, Charles Robert**, English naturalist: b. Shrewsbury, 12 Feb. 1809; d. Down, Kent, 19 April 1882. His father, Robert Waring Darwin, was a distinguished physician of that town, the son of a still more distinguished father, Erasmus Darwin (q.v.) He was educated at Shrewsbury school, and at the universities of Edinburgh and Cambridge. He early devoted himself to the study of natural history, and in 1831 was appointed naturalist to the surveying voyage of H.M.S. Beagle, commanded by Captain (afterwards Admiral) Fitzroy. He served without salary, and paid a portion of his expenses on condition of having at his own disposal such collections of specimens as he might make during the voyage. The vessel sailed in December 1831, and did not return till October 1836, after having circumnavigated the globe. Darwin came home with rich stores of knowledge, part of which he soon gave to the public in such works as his 'Journal of Researches into the Natural History,' etc. (1839), of the countries visited, the 'Zoology of the Voyage of the Beagle' (1840-42); 'Structure and Distribution of Coral Reefs' (1842); 'Volcanic Islands' (1844); 'Geological Observations' (1846). Though known among naturalists as a man of distinguished ability, to the general public his name was not familiar, when all at once it attained a celebrity second to none by the publication in 1859 of 'The Origin of Species by Means of Natural Selection.' This work, scouted and derided though it was at first in certain quarters, may be said to have worked nothing less than a revolution in biological science. In it for the first time was given a full exposition of the theory of evolution as applied to plants and animals, the origin of species being explained on the hypothesis of natural selection. The central idea of the work is that all forms of organic life are derived from a small number of primitive types, and that all the vast variety of vegetable and animal organisms now existing, or having formerly existed, have owed their origin to the slow and gradual operation of the modifying influence of local or special causes transmitted hereditarily; such forms as best suit any particular time and locality being selected and adapted by the action of natural laws for that time and locality. The theory of evolution was warmly taken up by some of the ablest men of science, and now there are few who have not in whole or in part given in their adherence to the principle. The rest of his works are largely based on the material he had accumulated for the elaboration of the great theory. See DARWINIAN THEORY. The principal are a treatise on the 'Fertilization of Orchids' (1862); 'Domesticated Animals and Cultivated Plants'; or 'The Principle of Variation, etc., under Domestication' (1867); 'Descent of Man and Variation in Relation to Sex' (1871); 'The Expression of the Emotions in Man and Animals' (1872); 'Movements and Habits of Climbing Plants' (2d ed., 1875); 'Insectivorous Plants' (1875); 'Cross and Self-Fertilization' (1876); 'Different Forms of Flowers' (1877); 'The Power of Movement in Plants' (1880); 'The Formation of Vegetable Mould' (1881); the latter dealing exhaustively with the common earthworm. Darwin was buried in Westminster Abbey. See 'Life and Letters of Charles Darwin' (1887).

## DARWIN — DARWINIAN THEORY

**Darwin, Erasmus**, English physician and poet: b. near Newark, Nottinghamshire, 12 Dec. 1731; d. near Derby, 18 April 1802. Settling at Lichfield he acquired a great reputation and an extensive practice. His son, Robert, was father of the famous Charles Darwin. Erasmus Darwin's name is chiefly remembered for his poem of 'The Botanic Garden,' which is comprised in two parts; the first treats of the 'Economy of Vegetation' (1792), the second of the 'Loves of the Plants' (first published in 1789). It was received with much favor; but a very ingenious parody, entitled: 'The Loves of the Triangles,' published in the 'Anti-Jacobin' (and written either by Canning or Frere), greatly damaged its popularity. In 1794 Dr. Darwin published the first volume of 'Zoonomia, or the Laws of Organic Life'; the second volume, completing the work, appeared two years afterward. In 1799 he published 'Phytologia, or the Philosophy of Agriculture and Gardening.'

**Darwin, Francis**, English botanist: b. Down, Kent, 16 Aug. 1848. He is the son of Charles Robert Darwin (q.v.); was educated at Trinity College, Cambridge, and studied medicine at St. George's Hospital in London. He did not practise medicine, but assisted his father in his work at Down, and was later made reader in botany at Trinity College. His works include: 'Life and Letters of Charles Darwin' (1887); 'Charles Darwin' (1892); 'Practical Physiology of Plants' (with E. H. Acton 1894); 'Elements of Botany' (1895); and a number of papers on botanical subjects.

**Darwin, George Howard**, English scientist: b. Down, Kent, 9 July 1845. He is the eldest son of Charles Robert Darwin (q.v.); was educated at Cambridge, studied law and was admitted to the bar, but did not practise. He was a fellow of Trinity College, Cambridge, 1868-78; was a member of the expedition to Sicily to observe the eclipse in 1870-71; and was appointed Plumian professor of astronomy and experimental philosophy at Cambridge in 1883. Among his writings are: 'Small Deflections of the Plumb Line due to the Movement of the Earth'; 'Periodic Orbits' (1896); 'Tides and Kindred Phenomena in the Solar System' (1898) and other papers on astronomical subjects.

**Darwinian Theory**, the explanation of the working of natural selection in effecting specific changes in plants and animals. "Darwinism" must not be confused with "Evolution." The term Darwinism is applied to one particular interpretation of the mechanism of the universe, and is summarized in Darwin's great work: 'The Origin of Species by Means of Natural Selection.' Whatever may be the future development of our evolutionary ideas, the epoch-making importance of the Darwinian theory will be unaltered.

**Outline of Origin of Species.**—To gain an insight into the means of modification, Darwin begins with a study of the variation of plants and animals under domestication. Those who admit the unity of domestic races should be cautious in denying the unity of the wild ones. Domestic races all exhibit adaptations to man's use or fancy, rather than to their own good. The key to this is man's power of selection. Nature gives successive variations, man accumulates these, so making for himself useful breeds, and often (for example, in sheep, cattle, roses, dahlias) pro-

foundly modifies their character even in a single human lifetime; so that in all the characteristics to which he pays attention they may differ more than the distinct species of the same genera. Unconscious selection, which results from everyone trying to possess and breed the best animals, is even more important than conscious selection. Two flocks of Leicester sheep kept equally pure appear quite different varieties after 50 years. Such slowly accumulated change explains why we know so little of the origin of domestic races; and its absence in regions inhabited by uncivilized man explains why these yield no plants worth immediate culture. Human selection is facilitated (1) by the keeping of large numbers, since variations will be more frequent; and (2) by preventing free intercrossing. Some species vary more than others.

**Variation Under Nature.**—No two blades of grass are alike, and far more marked differences often occur, several strains or varieties sometimes existing in the same species. Between these strains, and much more frequently between forms which systematic botanists and zoologists rank as true species, perfectly intermediate forms may occur. No agreement about the definition of species (the amount of difference necessary to give any two forms specific rank) has ever been reached. Individual differences are of the highest importance, as the first steps toward the slightest varieties worth recording; these in turn toward more distinct and permanent varieties; these varieties again toward sub-species, and in the next stage to species, though extinction may often arrest the process. The species which present most varieties are those which have the greatest geographical range, or the widest diffusion in their own territory, or which possess the greatest number of individuals.

**Struggle for Existence.**—All organic beings tend to increase with extreme rapidity, so that if they were not kept down, the earth would soon be covered by the progeny of a single pair. Since organisms are reproducing themselves so rapidly, and not all their offspring can escape their enemies, get food and live, much less leave progeny in turn, there must in every case be a struggle for existence, either of one individual with another of the same species, with the individuals of distinct species, or with the physical conditions of life; often with all these at once, and that more or less intensely throughout the whole duration of life. The checks which prevent increase are more obscure, and vary in each case. In all cases the amount of food gives the limit. The youngest organisms generally suffer most. The stock of game on an estate depends chiefly on the destruction of vermin. Climate is important, and periodic seasons of extreme cold and drought seem the most effective of all checks. Epidemics too may occur, especially where numbers have inordinately increased. The struggle for life is most severe among individuals and varieties of the same species, and among the species of the same genus, since these tend to fill the same place in the economy of nature. The structure of every being is related to that of the others with which it competes, or from which it seeks to escape, or on which it preys.

**Natural Selection.**—The natural process which results in the preservation of favorable variations, and the elimination of injurious ones, is termed by Darwin "Natural Selection," or less

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figuratively by Spencer, the "Survival of the Fittest." No country can be named where the native inhabitants are perfectly adapted to their conditions and competitors, for as some foreigners have taken firm possession in every country, we may safely conclude that the natives might have been modified with advantage to resist them. Human selection acts only for man's own good, on mere external and visible characters, and irregularly throughout a short period; natural selection acts for the good of the being itself, on the whole machinery of its whole life, and incessantly on the species, throughout almost infinite time. It leads to the improvement of each creature in relation to its organic and inorganic conditions of life, and consequently in most cases to what must be regarded as an advance in organization. The circumstances favorable to the production of new forms are great variability; large numbers of individuals; the complex effects of intercrossing; isolation in small areas; also extension over continental ones, especially if these vary in altitude; and considerable lapse of time. Rare species are shown to be in process of extinction. The divergence of character in domestic breeds, largely due to the fact that "fanciers do not, and will not, admire a medium standard, but like extremes," applies throughout nature from the circumstance that the more diversified the descendants from any one species become in structure, constitution and habits, by so much will they be better enabled to seize on many and widely diversified places in nature, and so to increase in numbers. A carnivorous animal which has reached the maximum numbers its territory can support, cannot succeed in increasing unless its varying descendants seize places hitherto occupied by other animals. This must hold equally true of all species, and is separately demonstrated for plants. The greatest amount of life can be supported by help of proportionally great diversification of structure; hence, in small areas where competition is severe, the inhabitants are extremely varied.

**Sexual Selection.**—Not merely do individuals struggle for existence, but the males struggle for the females, and the most vigorous tend to leave most progeny. Several weapons, offensive and defensive, like the cock's spurs, the stag's horns, or the lion's mane, are used in this struggle, and the most useful variations are those which are transmitted. Just as man can in a short time give beauty to his domestic birds, so there is no reason to doubt that female birds, in thousands of generations by selecting, as they are observed to do, the most melodious or beautiful males, might produce a marked result, and many sexual differences are thus explained.

**Laws of Variation.**—The same laws appear to have acted in producing the lesser differences between varieties of the same species, and the greater differences between species of the same genus. Specific characters are more variable than generic, and varietal than either. Rudimentary organs and secondary sexual characters are variable. Zebra-like stripes on horses, or wood-pigeon's markings on fantails, tumblers, etc., may be explained as reversion toward their ancient progenitors.

**Geological Succession of Organic Beings.**—The most ancient forms differ widely from those now living, yet frequently present characters intermediate between groups now widely divergent, and resemble the embryos of the more recent and

more highly specialized animals belonging to the same classes. These, and the important law of the succession of the same types within the same areas during the later geological periods, and most notably between the Tertiary Period and the present time, cease to be mysterious, and become at once thoroughly intelligible on the principle of inheritance, and on that alone. Darwin's belief that the distinctness of birds from all other vertebrates was to be accounted for by the extinction of a long line of progenitors connecting them with reptiles, was in 1859 a mere assumption; but in 1862 the long-tailed and palpably reptilian bird *Archæopteryx* was discovered, while in 1875 the researches of Marsh brought to light certain cretaceous birds, one with teeth set in a groove, the other with teeth in sockets, and with bi-concave vertebrae. Besides these reptilian birds, bird-like reptiles have similarly been forthcoming, and the hypothesis of Darwin is thus admirably verified.

**Geographical Distribution.**—Neither the similarity nor the dissimilarity of the inhabitants of various regions, whether of land or of sea, can be accounted for by identity or differences of climate, or other physical conditions; but both are related in the most striking degree to the absence or presence of barriers to migration between those regions.

**Morphological Arguments.**—The physiological and distributional lines of argument furnished by morphology are mainly four, and are derived from (a) Classification, (b) Homologies, (c) Embryology, (d) Rudimentary Organs. The great fact of classification is that organic beings, throughout all time, are arranged in groups subordinated under other groups, individuals under varieties, and these again under species; species under genera; genera under sub-families, families, and orders; and all under a few grand classes. The nature of all these relationships established by naturalists receives a simple and natural explanation on the view of the common descent of allied forms with modification through variation and natural selection, no other explanation ever having been attempted. The element of descent is already used in linking all the sexes, ages, forms, and varieties of the same species, widely though these may differ from each other in structure.

The members of the same class, independently of their habits of life, resemble one another in their general plan of organization. Thus the hand of man, the digging-paw of the mole, the leg of the horse, the paddle of the porpoise, and the wing of the bat, are all constructed on the same pattern, bone corresponding to bone. This conformity to type is "powerfully suggestive of true relationship, of inheritance from a common ancestor"; and admits of a simple explanation in terms of the evolutionary theory, thus strengthening that theory.

**Serial Homology** is that unity of type which is found on comparing the different parts and organs in the same individual. The complex and varied jaws and legs of a lobster, or the different leaves, sepals, petals, stamens, and pistils of a flower, are all found to be modifications of a simple limb and a simple leaf-organ respectively. Not only are such metamorphoses apparent on comparison, but they can be actually observed during the development of each individual. So closely do the embryos of the most distinct species belonging to the same class resemble each

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other, that even Von Baer was unable to decide whether two unlabelled specimens were lizards, birds, or mammals. The process of development goes from the general to the special; thus there is generally an advance in organization. In peculiar conditions degeneration may occur. All these facts are explained on the principle of successive slight variations not necessarily or generally supervening very early in life, and inherited at a corresponding period; hence it is in the highest degree probable that most embryonic stages show us more or less completely the progenitor of the group in its adult state; and embryology thus rises greatly in interest. Darwin points out that the theory of evolution by natural selection is no more inimical to religion than is that of gravitation, to which the same objection was raised.

JOHN FISKE.

**Darwinian Tubercle**, a small raised portion, or tubercle, that may be found on the pinna of the ear. It is said to be present in a number of the primates and by many scientists has been regarded as an evidence of degeneracy in mankind. Different forms of Darwinian tubercles are described by anthropologists, but they have no real special significance.

**Dasent**, dā'sěnt, **SIR George Webbe**, English philologist and novelist: b. St. Vincent, West Indies, 1820; d. near Ascot, Berkshire, 11 June 1896. He was for a while one of the editors of the London *Times*, and was one of the civil service commissioners. He was eminent as a scholar in the Norse languages, particularly Icelandic, and translated the 'Younger Edda,' besides many other ancient stories and legends of Iceland, and wrote 'The Norseman in Iceland' (1858); 'The Story of Burnt Njal' (1861). Among his original stories are: 'Annals of an Eventful Life'; 'Three to One'; 'Half a Life.'

**Dash**, Countess, pseudonym of **Gabrielle Anne Cisterne de Courtiras**, VICOMTESSE DE SAINT-MARS. French novelist: b. Poitiers, 2 Aug. 1804; d. 11 Sept. 1872. She was a very prolific writer, producing often five or six stories in the course of a year. Life in high society is her theme, and especially wayward love in high society, as the titles of most of her novels indicate: 'Bussy-Rabutin's Amours'; 'Gallantries of the Court of Louis XV.'; 'Last Amours of Mme. du Barry'; 'Adventures of a Young Married Woman.'

**Dashkoff**, dāsh'kōf, **Princess Ekaterina Romanovna**, Russian scholar: b. St. Petersburg 22 March 1743; d. 16 Jan. 1810. She married Prince Dashkoff when only 15 years old, but was left a widow three years after. She was an intimate friend of the Empress Catharine II., and one of the heads of the conspiracy formed against Peter III., the success of which secured the throne to Catharine. Soon afterward quarreling with Catharine, she obtained permission to travel, and visited Germany, England, France, and Italy, making the acquaintance of many eminent men. On her return the princess was appointed director of the Academy of Arts and Sciences; and in 1783, president of the Russian Academy, established at her own suggestion in imitation of the French Académie. Besides writing several comedies and occasional papers, the Princess Dashkoff was mainly instrumental in inducing the Russian Academy to draw up a dictionary

of the Russian language, and herself executed part of the work. See her very interesting autobiography (trans. 1840).

**Daskam**, Josephine Dodge, American writer: b. Stamford, Conn., 17 Feb. 1870. She was educated at Smith College and in addition to frequent contributions to magazines has published in book form 'Smith College Stories' (1900); 'A Sister's Vocation and Other Girls' Stories' (1900); 'The Imp and the Angel' (1901); 'The Madness of Philip' (1900); 'The Best Nonsense Verses' (edited; 1902).

**Dass**, däss, **Peder**, päd'er, or **Petter**, Norwegian poet: b. Nord-Herø, parish of Alstahoog, Nordland, 1647; d. Aug. 1708. He studied at the University of Copenhagen, became pastor of the parish of Alstahoog in 1680 and grew rich from commerce and fisheries, buying for himself the royal domain of Vefsen. He became the most popular poet in Norway, leaving 127 poems of which only 24 are now extant, his masterpiece being a descriptive poem: 'The Trumpet of the Nordland,' written in the Dano-Norwegian dialect.

**Dassy**, or **Dassie**, the name given in South Africa to the rock-rabbit (*Procapra capensis*), the Dutch name for which is klip-das. The name dassy is merely a diminutive in local use, especially in Cape Colony. See HYRAX.

**Dasyproc'ta**, a genus of agoutis (*Dasyproctidae*), a familiar group of rodent mammals inhabiting Central and South America, and some of the West India Islands. The agoutis are a little larger than the common rabbit, have a rabbit-like head, but with short ears, hooped, pig-like claws, and are swift-footed. They live in the woodland, and search for food by night in the open country.

**Dasyure**, dās'ī-ūr, a marsupial native to Australasia; and belonging to the family *Dasyuridae*. It is the survivor of the fossil forms found in Tertiary strata in South America, and elsewhere; and is allied to the opossum. The hind and fore legs are about equal in length, and the toes are furnished with claws; the long hairy tails are not prehensile. The dasyures are chiefly strong, fierce creatures of cat-like propensities, whose depredations have caused heavy losses in farming and ranching districts, so that the colonists of Australasia, more especially those of Tasmania, have nearly exterminated them, by persistent effort. Among them we find the Tasmanian zebra-wolf (*Thylacinus cynocephalus*), a wolf-like creature, rather smaller than the common wolf, with short fur, a long smooth tail, and rounded ears. Its color is brownish, and it is barred at the hinder portion of the back and the roots of the tail with dark stripes. It prowls about by night, making raids upon unguarded sheep-folds. By day, it skulks in caverns among the rocks. Another foe to the flocks is the Tasmanian Devil (*Sarcophilus ursinus*). This creature, in size like a badger, in appearance like a bear, is ponderous, powerful, dark-colored, and covered with a coat of long fur. It sleeps by day; and, like the zebra-wolf, seeks its prey by night. It is very strong and ferocious; but despite this, has been successfully put down by the colonists; in fact, it has been nearly exterminated. Another species is the Australian "native cat," a spotted creature, almost as large as a house-cat. It belongs to the genus *Dasyurus*,

## DATARIA — DATE-SHELL

in which are also several other and smaller species. Perhaps the most interesting of the small Dasyures, is the banded ant-eater (*Myrmecobius fasciatus*) found in western and southern Australia. It is a reddish brown in color, banded posteriorly with white; is about the size of a squirrel, and has a long protrusile tongue for gathering its insect food. It is considered as a practically unmodified representative of certain extinct marsupials found in the Secondary rocks of Europe. It lives in sandy plains, where it finds food in plenty. Other species, small as rats and mice, and living chiefly on insects, birds, eggs, etc., are found in the genus *Phascogale*, and allied genera; and the jerboa-like creature (*Antechinomys laniger*) constitutes another genus, of a single species. It is native to Queensland and New South Wales, but is very rare. See MARSUPIALS.

**Data'ria**, an office of the Curia Romana (q.v.) from which are sent forth certain classes of papal documents, as dispensations and appointments to Church benefices. The word had its origin in the formula of subscription of letters, for example, *Data Kalendis Martii*, given (or sent) 1 March; that is the date of the document; and it is the duty of the Dataria to guard against possible errors of either dating or addressing documents, or in the tenor of the documents themselves.

**Date**, any given, fixed, or settled time; the time when any event happened; period; era; age; epoch; as, the date of the Christian era, the date of a historical occurrence, etc. Also, that addition to a writing which specifies the year, month, and day when it was given or executed; the number which marks the time when any writing, instrument, coin, picture, etc., was executed. Under the Romans the word *datum* was used to signify the day on which the bearers of imperial despatches received them at Rome, or delivered them in the provinces. It was also employed in documents in the time of the French Merovingian kings. See EPOCH; CHRONOLOGY.

**Date Line**. See INTERNATIONAL DATE LINE.

**Date**, or **Date Palm** (*Phoenix dactylifera*) a tall tree of the natural order *Palmaceæ*. It is most notable for its fruit, which is an important part of the daily food of the natives of western Asia and northern Africa, where the tree is indigenous and from whence large quantities of dried dates (the fruits), are exported to other countries. The tree is also cultivated in some other warm countries, including China, Italy, France, Spain and parts of the United States, — Florida, New Mexico, Arizona and California, in the last three of which a promising industry seems to be becoming started. The tree, which attains a height of 100 feet, and bears fruit for one or two centuries, is, like other palms, useful in many ways; nearly all its parts are used for something. Date seeds are roasted and used as a substitute for coffee, or ground and pressed for oil and the pomace used for stock food. The leaves are used for matting, baskets, thatch, etc.; the terminal bud as a vegetable: the wood for fence making and other purposes where great strain is not expected; the fibre of the bark for making rope; but the fruit, which contains proteids, gum, and pectin, and is particularly rich in sugar, is the most important part. It is one

of the principal sources of wealth in the countries where the date is indigenous. It is believed that the leaves of this palm are the ones referred to in biblical writings, and at the present time the leaves of this palm are largely used upon Palm Sunday among Christians living where the trees abound. The leaves were also symbolical of victory, beauty, etc., among the ancient Greeks and Jews.

Since the male and female flowers are borne on separate trees, enough specimens of staminate flowering trees must be planted to fertilize the blossoms on the others which alone produce fruit. Since the plants obtained from seeds are of unknown sex until they flower, and since the proportion of inferior seedlings to seedlings which bear superior fruit is very large, the date is propagated by means of suckers, since these retain the characteristics of the parent. The young plants are set in sunny situations, in almost any kind of soil where water is within reach of the roots or can be supplied by irrigation. The sandy, alkaline soils of deserts seem more satisfactory than the richer soils necessary for the growth of general crops. The trees are very difficult to make grow after transplanting, because they demand special attention especially as to watering. A loss of 50 per cent is not uncommon even with the best of attention. The surviving trees should commence to bear when about eight years old. The fruit is borne in clusters which hang from the thick crown of large pinnate leaves. Individual trees produce from 300 to 500 pounds or more of fruit in a season. Consult: Bulletin No. 29, Arizona Experiment Station, Phoenix, Arizona.

**Date-plum**, a common name for plants of the genus *Diospyros*, of the ebony family (*Ebenacæ*). The genus has about 100 species and is most abundantly represented in Asia. In America two species are known, the most common being the persimmon (q.v.), *D. virginiana*. The common date-plum or pishamin, also called the European lotus and the date of Trebizond (*D. lotus*), is a tree 18 to 30 feet high, with oblong shining leaves and small reddish-white flowers, a native of the coasts of the Caspian Sea, northern Africa, etc., but cultivated and naturalized in the south of England. Its fruit is of the size of a cherry, and in favorable climates larger, yellow, sweet, and astringent. It is eaten when overripe, like the medlar, or is used for preserves. This fruit has been supposed by some to be the *lotus* (q.v.) of the Lotophagi. *D. mabola* is cultivated as a fruit-tree in Mauritius. *D. kaki*, sometimes called the keg-fig, is a native of Japan, and occasionally is kept in greenhouses in France and England. The sweetmeat called *figues-caques* is made from this fruit in France. The fruit of some other species is also edible, as, for example, that of *D. decandra* of Cochin-China. See EBONY; PERSIMMON.

**Date-shell**, or **Date Fish**, a bivalve shell or its inhabitant of the genus *Pholas*, a kind of mollusk. They bore holes in clay, peat, and soft rocks, and in some instances in hard stone, as in columns from the Temple of Serapis, which were brought from Africa to Italy. Species of the date-shell are found in the Mediterranean and its arms, on the coast of California and in a few places on the west shore of the Pacific. Some are edible.



**Datha**, American cacique. He governed the province of Chicora, on the east coast of Florida, visited by Lucas Vazquez de Ayallon, auditor of San Domingo, in 1520. He was a giant, and Helps, in the 'Spanish Conquests in America,' says: "His gigantic stature had been artificially produced, for it is said that the Indians of those parts had a method of elongating the bones of children when very young, a practice which they applied to those of royal race."

**Datholite**. See DATOLITE.

**Datia**. See DUTTEAH.

**Datiscin**, da-tis'sin, a substance yielded by the bastard hemp, *Datisca cannabina*, a common plant in gardens, indigenous to the Punjab, and largely used in the south of Europe and in Asia for dyeing yellow. It can be extracted from the leaves and roots by exhausting with alcohol, concentrating, adding water, filtering from a resin, crystallizing and purifying the glucoside so obtained. When pure it forms colorless silky needles, which are readily soluble in alcohol, sparingly in ether and in water, and have a bitter taste. It has feeble acid properties, and gives yellow compounds with lead and tin which can be used as dyes. When boiled with dilute acids it is resolved into sugar and *datisctin*, which crystallizes readily. It is soluble in alcohol and in ether, almost insoluble in water. It also gives a fine yellow color when combined with lead.

**Dative**, in grammar, one of the cases of nouns and pronouns, the usual function of which is to mark the recipient of something given. In English there is no distinctive form for this case; yet when we say, for instance, "give me or him that," "I gave the man a crown," *me*, *him*, and *man* are really in the dative. In Latin, Greek, Sanskrit, German, etc., there are distinct forms for this case. See CASE.

**Dattiya**. See DUTTEAH.

**Dat'olite**, dāt'o-lit, or Dath'olite, a basic silicate of boron and calcium, having the formula  $H_2O.2CaO.B_2O_3.2SiO_2$ , and crystallizing in the monoclinic system. Its crystals are glassy in appearance, white in color (often with a greenish tinge), and transparent or translucent. Before the blow-pipe it melts with intumescence, and gives a green color to the flame. Its hardness is from 5 to 5.5, and its specific gravity is about 3. In the United States it occurs in Connecticut, New Jersey, and the Lake Superior district. It is also found in the Salisbury Crags near Edinburgh, as well as in Norway, Sweden, and other parts of the European continent. The name is from two Greek words that refer to the tendency that one of its massive varieties exhibits, to divide into granular portions. The crystals when polished are used as ornaments.

**Datura**, da tū'ra, a genus of plants of the potato family (*Solanaceæ*). It contains about 125 species, widely distributed. The genus is represented in the United States by coarse weeds naturalized from tropical America. Jamestown or Jimson weed (*D. stramonium*) is said to have received its name from a poisoning that occurred from its use by the settlers of

Jamestown, Va. It is also called thorn-apple. It is found in waste places from the eastern seaboard west to Minnesota and Texas. The purple thorn-apple or purple stramonium (*D. tatula*) is found throughout the same region as the Jimson weed, but the entire-leaved thorn-apple (*D. metel*) does not grow far from the Atlantic coast. An extract from these plants is used in medicine. When taken internally it is a powerful narcotic; medically it is used in mania, convulsions, epilepsy, tic-douloureux, etc. When smoked it palliates the symptoms in asthma. *D. tatula* and *metel* are similarly used. The seeds of these two latter species are said to have been used to produce the frenzied ravings of the priests in the Delphic and some other temples. The Peruvians use for the same purpose *D. sanguinea*, manufacturing from it also an intoxicating beverage.

**Datu'rine**, a poisonous alkaloid found in the thorn-apple (*Datura stramonium*), and now known to be identical with atropine (q.v.).

**Daub**, dowp, Karl, German Protestant theologian: b. Cassel, Germany, 20 March 1705; d. Heidelberg, Baden, 22 Nov. 1836. Professor of theology at Heidelberg from 1795. His works include 'Lehrbuch der Katechetik' (1801); 'Theologumena' (1806); 'Die Dogmatische Theologie jetziger Zeit' (1833), etc.

**Dauban**, Jules Joseph, zhül zhō'zéf dö-bän, French painter: b. Paris 31 May 1822. He was a pupil of Auguste Debay. His taste led him to historical and religious subjects, and his compositions, severe in design and of a great simplicity in the accessories, are somewhat cold and sober in color. He became director of the museum and the School of Fine Arts in Angers in 1849, received a medal in 1864 and the decoration of the Legion of Honor in 1868. Among his works are: 'Louis XI. presenting Guillaume de Cerizay as Mayor of Anjou' (1861); 'Reception of a Stranger by the Trappists' (1864), Luxembourg Museum; 'Trappists Exchanging the Kiss of Peace before Communion' (1865), Museum of Angers; 'Madame Roland Going to the Revolutionary Tribunal' (1869); 'Fra Angelico da Fiesole' (1873); and several portraits and decorative paintings.

**Daubenton**, Louis Jean Marie, loo-ê zhöhn mä-rê dö-bän-tôn, French naturalist and physician: b. Montbard Côte-d'Or, France, 29 May 1716; d. Paris 31 Dec. 1799. He became celebrated for his participation in the Natural History of Quadrupeds by his friend Buffon; the anatomical part of which was prepared by Daubenton with great accuracy, clearness, and sagacity. In 1744 he was chosen member of the Academy of Sciences, and enriched its publications by a number of anatomical discoveries, and also by researches concerning the species of animals and their varieties, the improvement of wool, and the treatment of the diseases of animals. He threw much light upon mineralogy, botany, and agriculture, and proposed a new method for the classification of minerals. He was the author of numerous works of general utility: for example, 'Instruction pour les Bergers' (1782); 'Mémoire sur les Indigestions,' and many others. He became professor of natural history in the College of Medicine in 1778, and about seven years after professor of mineralogy in the Museum of Natural History. Dur-

ing the Reign of Terror, when every one was required to give some evidence of patriotic spirit, he was represented to his section as employed in introducing the Spanish sheep into France.

**Daubeny**, dâ'bē-nī or dōb'nī, **Charles Giles Bridle**, English scientist: b. Stratton, Gloucestershire, 11 Feb. 1795; d. Oxford 12 Dec. 1867. He was educated at Winchester College and Magdalen College, Oxford, and practised for some years as a physician in Oxford. In 1818 he visited Auvergne, and in 1837 made a scientific visit to the United States. In 1822 he was admitted a Fellow of the Royal Society, and from 1822 to 1855 was professor of chemistry in the University of Oxford. In 1834 he became professor of botany, and in 1840 of rural economy in the same university. He held the last appointment till his death. His principal works are: 'A Description of Active and Extinct Volcanoes' (1826); 'An Introduction to the Atomic Theory' (1831; with a supplement, 1840); 'Report to the British Association on Mineral and Thermal Waters' (1836); 'Lectures on Agriculture' (1841); 'Sexuality of Plants' (1860); 'Climate' (1863).

**D'Aubigné**, Jean Henri Merle, zhōn ōn-rē mērl dō-bēn-yā, Swiss ecclesiastical historian: b. Eaux-Vives, near Geneva, Switzerland, 16 Aug. 1794; d. Geneva 21 Oct. 1872. In 1818 he became pastor of the French Protestant Church in Hamburg. In 1823 he was appointed court-preacher at Brussels; but after the revolution of 1830 returned to Geneva, and filled the chair of Church history in its theological seminary until his death. The work which has given him a widespread reputation is his 'Histoire de la Réformation au Seizième Siècle' (1835-53); it has been translated into most European tongues, and has attracted more notice abroad than at home; it is written with a devout, fervid sympathy that is often eloquent, although the narrative is too graphic to be everywhere exact. Its popularity has been very great. Among his other writings are: 'Germany, England, and Scotland' (1848); a vindication of Cromwell (1848); 'Trois Siècles de Lutte en Ecosse' (1849); and 'Histoire de la Réformation en Europe au Temps de Calvin' (1862-78).

**D'Aubigné**, Merle. See D'AUBIGNÉ, JEAN-HENRI MERLE.

**D'Aubigné**, Théodore Agrippa. See AUBIGNE, D'.

**Daubigny**, Charles François, shārl frān-swā dō-bēn-yē, French landscape painter and etcher: b. Paris 15 Feb. 1817; d. there 19 Feb. 1878. He studied under his father, who was a miniature painter, Paul Delaroche, and others; and from 1838 exhibited in the Salon, though his full recognition came only after the artist had reached his 50th year. He devoted himself to close and sympathetic study from nature, working much on the Seine in a house-boat, and developed a style of landscape art marked by singularly unaffected fidelity and originality. In 1853 he gained a first-class medal with his 'Pool of Gylion.' In 1857 he produced his 'Springtime'; in 1861 'The Banks of the Oise'; in 1872 'Windmills at Dordrecht'; and in 1877 his large and very impressive 'Rising Moon.' His 'Sluice in the Valley of Optevos' (1855), and his 'Vintage' (1863), are in the

Luxembourg Gallery. His is also known as a book-illustrator and as a vigorous etcher, having produced over 100 plates, some reproductions, others direct from nature, marked by great frankness of method and free painter-like quality. See Henriot, 'Daubigny et son œuvre' (1878); Van Dyke, 'Modern French Masters' (1896); Stranahan, 'History of French Art' (1900).

**D'Aubusson**, Pierre. See AUBUSSON, PIERRE D'.

**Daucus**, dâ'kūs, the typical genus of the *Umbellifera* or carrot family. The genus has about 25 species, two of them growing wild in America. Wild carrot, crow's-nest, or Queen Anne's lace (*D. carota*), is generally a pernicious and abundant weed throughout the Union. It is a native of Asia, naturalized from Europe. It is the original of the cultivated carrot. See CARROT.

**Daudet**, Alphonse, āl fōns dō-dā, French novelist: b. Nîmes 13 May 1840; d. Paris 16 Dec. 1897. He was educated at the Lyons Lycée, and for two years after leaving it supported himself as an usher at Alais. Going to Paris in 1857 he took to writing verse, his first volume being 'Les Amoureuses' (1858), which met with some success. This was followed by other poems, including 'La Double Conversion' (1859), and at this time he also contributed to the 'Figaro,' and other journals. About 1862 he began writing for the stage, and during the succeeding 10 years or so several dramas by him were represented, but with only moderate success. These included: 'La Dernière Idole' (1862); 'L'Éillet Blanc' (1865), and 'Le Frère Aîné' (1868). Greater public favor was accorded to his 'Lettres de Mon Moulin,' which appeared in 1866 in a Parisian journal. In 1872 he produced his celebrated 'Les Aventures Prodigieuses de Tartarin de Tarascon,' an amusing satire on the boastfulness so characteristic of the south of France. From this time he published numerous works, some of the best being: 'Fromont Jeune et Risler Aîné' (1874); 'Jack' (1876); 'Le Nabab' (1877); 'Les Rois en Exil' (1879); 'Numa Roumestan' (1881); 'L'Évangéliste' (1883); 'Sapho' (1884); 'Tartarin sur les Alpes' (1885), a sequel to 'Les Aventures Prodigieuses'; 'Trente Ans à Paris' (autobiographical), (1887); 'Souvenirs d'un Homme de Lettres' (1889); 'Port Tarascon, dernières Aventures d'Illustre Tartarin' (1890); 'Rose et Ninette' (1892); 'La Mentreuse' (1893); 'Entre les Frises et la Rampe' (1894); 'La Petite Paroisse' (1895); 'Contes d'Hiver' (1896); 'L'Enterrement d'une Étoile' (1896); 'Les Mères' (1896); 'Le Trésor d'Arlatan' (1897); 'La Fédor' (1897); and 'Soutien de Famille' (1897). M. Daudet has often been compared with Dickens in his mastery of pathos and humor. Some of his principal works rely mainly on his great powers of caricature for their success. His chief works have been translated into English and in this dress have been very popular. See Brunetière, 'Le roman naturaliste' (1896).

**Daudet**, Ernest Louis Marie, èr-nā loo-ē mā-rē, French novelist: b. Nîmes 31 May 1837. He is a brother of Alphonse Daudet (q.v.). His most notable novels are: 'The Venus of Gordes'; 'The Bloom of Sin'; 'Martha.' He

## DAUGHTER OF THE CONFEDERACY—DAUN

is author of an autobiographical sketch, 'My Brother and Myself' (1882); and has written some historical sketches, as a 'History of the Royalist Conspiracies in the South During the Revolution' (1881); 'History of the Emigration' (1886); 'Les Bourbons et la Russie pendant la Révolution Française' (1888).

**Daughter of the Confederacy.** See DAVIS, VARINA ANNE JEFFERSON.

**Daughters of the American Revolution,** a society composed of women who are descendants of ancestors, any of whom "with unflinching loyalty rendered material aid to the cause of independence as a recognized patriot, as soldier or sailor, or as a civil officer in one of the several colonies or States." It was organized in Washington, D. C., 11. Oct. 1890.

**Daughters of the Confederacy, United,** an association of the widows, wives, mothers, sisters, and lineal female descendants of men who served honorably in the army and navy of the Southern States, or who gave personal services to the Confederate cause. It was organized at Nashville, Tenn., 10 Sept. 1894.

**Daughters of the Holland Dames,** a colonial society of women, the official title being "The Daughters of Holland Dames, Descendants of the Ancient and Honorable Families of New York," was incorporated for the purpose of erecting a memorial to commemorate the early Dutch period of our colonial history, and to preserve and collect historical documents relating to the same. The headquarters are in New York. This society is not connected with the Holland Dames.

**Daughters of the King,** a Protestant Episcopal order of women (not to be confounded with the King's Daughters), organized in 1885. The aim of the society is to bring young women within the influence of the Church and to co-operate with the rectors of parishes to that end. President, Mrs. E. A. Bradley. The office of the council is in New York.

**Daughters of the Revolution,** a patriotic society of women in the United States, organized in 1891. Eligibility to membership is restricted to "women who are lineal descendants of an ancestor who was a military or naval or marine officer, soldier, sailor, or marine, in actual service under the authority of any of the 13 Colonies or States, or of the Continental Congress, and remained always loyal to such authority, or descendants of one who signed the Declaration of Independence, or of one who as a member of the Continental Congress or of the Congress of any of the Colonies or States, or as an official appointed by or under the authority of any such representative bodies, actually assisted in the establishment of American independence by service rendered during the War of the Revolution, becoming thereby liable to conviction of treason against the government of Great Britain, but remaining always loyal to the authority of the Colonies or States." There are numerous subordinate State organizations.

**Daughters of 1812.** See UNITED STATES—DAUGHTERS OF 1812, NATIONAL SOCIETY OF.

**Daulatabad,** dow-lāt-ā-bād' ("fortunate city"), India, a town and fort in the Deccan, within the Nizam's dominions, 28 miles north-

west of Hyderabad. The fortress consists of a conical rock, 600 feet high, with a wide ditch and an outer wall nearly three miles in circumference. The place surrendered to the Mohammedans in 1294, and Shah Muhammad Tughlak (1324-51) thrice attempted to remove the seat of government hither from Delhi. The fortress has not been garrisoned now for many years, and the town has greatly decayed. Pop. 1,243.

**D'Aulnoy, dōl'nwā, Marie Catharine Jumelle de Berneville,** zhu-mēl de bār-nē-vēl, COUNTESS, French writer: b. about 1650; d. 1705. She wrote many romances, long consigned to safe oblivion, but her fame rests securely on her 'Fairy Tales,' written in a simple, bright, and charming style, not altogether unworthy of Perrault. 'The White Cat,' the 'Yellow Dwarf,' 'Finette Cendron,' and 'Le Mouton' have for two centuries been naturalized in the nurseries of Europe, and are still familiar figures in pantomime. Her altogether delightful 'Travels in Spain' was reissued in New York in 1898.

**Daumer, Georg Friedrich,** gā'örg frēd-rīr dow'mēr, German writer: b. Nuremberg 5 March 1800; d. Würzburg 14 Dec. 1875. He underwent some remarkable revolutions of thought concerning religion; in his student days leaned strongly to Pietism; next was the declared foe of the Christian religion; and about 1859 embraced Catholicism and became one of its foremost champions. He wrote among many other philosophical treatises: 'Hints Toward a System of Speculative Philosophy' (1831); to his second period belongs: 'The Fire and Moloch Worship of the Hebrews' (1842); to his third: 'My Conversion' (1859). Of his poetical works, the 'Flowers of Song from Hafiz' may be named—a very beautiful transcription of the Oriental poet, with free variations in the very spirit of Hafiz himself. He wrote also 'Beautiful Souls: a Little Wreath of Legends and Poems' (1862); 'Legends and Poems of St. Mary.'

**Daumier, Honoré,** ô-nô-rā dô-mē-ā, French caricaturist: b. Marseilles 26 Feb. 1808; d. Valmondois 10 Feb. 1879. Fashion, titillation, scandal, politics, blemishes of figure, and oddities of character in turn inspired his inexhaustible genius for mockery. Few among his illustrious contemporaries escaped his pencil, and his caricatures had always some strikingly truthful feature about them. He made his debut in the 'Charivari,' in a series of sketches from 'Robert Macaire'; and the revolution of 1848 suggested two of his most remarkable series, 'Parliamentary Idylls' and 'The Representatives Represented.' In his old age Daumier became blind, and was befriended by Corot, the landscape painter. See Alexandre, 'Honoré Daumier, l'homme et son œuvre' (1890).

**Daun, Leopold Joseph Maria,** lā'ô-pôld yô'sēf mā-rē-ā down, COUNT VON, Austrian general: b. Vienna 25 Sept. 1705; d. 5 Feb. 1766. He served in the Turkish war in 1710; as major-general in Italy in 1734; and distinguished himself at the battle of Kozka in 1737, and the capture of Dingelfingen in 1740. In 1748, after serving against the French in the Netherlands, he was made Knight of the Golden Fleece. He

## DAUPHIN — DAVENPORT

defeated Frederick the Great at Kolin in 1757, and again at Hochkirch in 1758.

**Dauphin**, dâ'fin, Fr. dō-fân, the title of the eldest son of the king of France. Dauphin was originally a title held by several of the feudal lords of France, and is believed to have originated from the dolphins (Fr. *dauphin*) worn on their helmets or used as a family crest. In 1349 Humbert II., dauphin of Viennois, being childless, transferred his estate, called the Dauphiny (*le Dauphiné*), in the south of France, to Philip of Valois, on condition that the eldest son of the king of France should in future be styled the dauphin, and govern this territory. The dauphin, however, retained only the title, the estates having been united with the crown lands. On the death of the dauphin his eldest son inherited this title; if he had no son his eldest brother succeeded him. If the king had no son, as was the case in the reign of Louis XVIII., the title of dauphin was not bestowed on any one; for it was never given to the next prince of the blood and presumptive heir, even if he were the king's brother. The wife of the dauphin was called dauphiness (*dauphine*). The *Delphin* classics were editions made for the use of the dauphin (*in usum delphini*).

**Dauphiné**, dō-fên-ā, one of the ancient provinces of France. It was divided into Upper and Lower Dauphiné. It forms the departments of the Isère, the Hautes Alpes, and part of that of the Drôme. The capital of the whole was Grenoble. The province constituted a sort of triangle, bounded north by Bresse and Savoie, east by Piedmont, south by Provence, and west by the Rhone.

**Daurat, Jean**, zhōn dō-rā, French scholar: b. about 1510; d. 1588. He became president of the College Coqueret, where he superintended the studies of Ronsard, Du Bellay, Baif, and Belleau. These poets he carefully trained for the task of reforming the vernacular, and ennobling French literature by the imitation of Greek and Latin models. He wrote nothing of importance in French, but devoted himself to guiding and stimulating the other members of the Pléiade, in whose works his learning and enthusiasm bore rich and enduring fruit.

**Dauw**, dâ, or **Peechi** (*Equus burchelli*), an animal closely resembling the zebra, which inhabits the plains of southern Africa, particularly to the north of the Orange River. It is about the size of an ass, but more delicately formed. Its general color is a pale brown, with grayish-white on the abdomen and inner parts of the limbs. Its head, neck, and body, and the upper parts of its limbs are striped like the zebra, but the stripes are not so dark in color. It migrates periodically in search of food, and in times of scarcity visits the cultivated lands and makes havoc of the crops. It has been tamed to some extent, but its temper cannot be relied on. The Dutch colonists call it Bonte-quagga. It is known also as Burchell's zebra. See ZEBRA.

**Davao**, dā-vā'ō, Philippines, a province in the southeastern part of the island of Mindanao; area 8,976 square miles; with dependent islands 9,171 square miles. Most of the communication between towns and villages is by sea, as almost all are on the coast; there are a few roads, and the United States troops have done

much to improve them. Hemp, coffee, tobacco, rice, and corn are cultivated; the cinnamon tree, the betel nut, cloves, and nutmeg grow without cultivation; large numbers of horses, cattle, and hogs are raised. There are indications of deposits of coal and some gold, and there are many valuable forests. Davao was occupied by United States troops in December 1899, and was given civil government in 1903.

**Dav'enant**, SIR William, English poet and dramatist: b. Oxford February 1606; d. London 7 April 1668. He was employed in preparing several masques for the entertainment of the court; and on the death of Ben Jonson in 1637, succeeded to the vacant laurel. On hostilities breaking out between Charles I. and the Parliament, Davenant displayed his attachment to the royal cause. At the siege of Gloucester in 1643, he was knighted by the king; and on the decline of the royal cause retired to France, where he became a Roman Catholic, and began the composition of his principal work, a heroic poem, entitled 'Gondibert.' An attempt which he afterward made to lead a French colony to Virginia had nearly proved fatal to him. The ship in which he had sailed from Normandy was captured by a cruiser in the service of the English Parliament, and carried into the Isle of Wight, where Davenant was imprisoned in Cowes Castle. In this forlorn captivity, from which he had but little hope of escaping alive, he composed the third book of 'Gondibert.' In October 1650 he was removed to London for trial before the high commission court. His life is said to have been preserved by the interposition of Milton. There is a corresponding tradition, that Davenant repaid the good offices of Milton by protecting the republican poet after the Restoration. On the return of Charles II. to England the stage was re-established with renewed splendor, and Davenant became patentee of a theatre in Lincoln's Inn Fields. He continued to employ his pen and his talents as a theatrical writer and manager till his death. He was buried in Westminster Abbey. His works consist of dramas, masques, addresses, and the epic 'Gondibert,' which was never finished; but he is remembered chiefly by the reconstruction of Shakespeare's 'Tempest,' in which he was engaged along with Dryden, a work which long held the stage in place of the original, although unequivocally condemned by modern criticism as a vulgar and degraded version of a drama which stood in need of no such emendation.

**Dav'enport**, Charles Benedict, American zoologist: b. Stamford, Conn., 1 June 1866. He was graduated from Harvard in 1889; is a director of the biological laboratory of the Brooklyn Institute of Arts and Sciences, and in 1899 was appointed professor of zoology at the University of Chicago. He has written: 'Experimental Morphology' (1897-9); 'Statistical Methods in Biological Variation' (1899); and 'Introduction to Zoology' (with G. C. Davenport, 1901).

**Davenport**, Cyril James, English librarian: b. Stirling, Scotland, 5 June 1848. He has been a librarian in the British Museum since 1868 and has published: 'The English Regalia' (1897); 'Royal English Bookbindings' (1897); 'Cantor Lectures on Decorative Bookbindings'

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(1898); 'English Embroidered Bookbindings' (1899); 'Cantor Lectures on Cameos' (1900); 'Life of T. Berthelet' (1900); 'Personal Jewellery' (1902).

**Davenport, Edward Loomis**, American actor: b. Boston 15 Nov. 1814; d. Canton, Pa., 1 Sept. 1877. His first appearance was made in 1836 at Providence, R. I., as Parson Will in 'A New Way to Pay Old Debts,' with Junius Brutus Booth as Sir Giles. In 1838 he played in Philadelphia. He soon became a leading performer in comedy, melodrama, and tragedy. Up to 1847 he appeared chiefly in Boston. In that year he went to England with Mrs. Mowatt, there playing Claude Melnotte in 'The Lady of Lyons,' with Mrs. Mowatt as the Pauline. For two seasons he supported W. C. Macready. In 1854 he returned to the United States, where he traveled extensively, playing especially Shakespearean parts and those in dramatizations of Dickens. As Brutus in 'Julius Caesar' and Bill Sykes in 'Oliver Twist' he was equally successful. Among his other characters were Sir Giles Overreach and Hamlet. In 1859 he became manager of the Howard Athenæum, Boston, in 1869 of the Chestnut Street Theatre, Philadelphia. His versatility and finish were notable. Consult Edgett, 'E. L. Davenport' (1901; Dunlap Society Pub., new series, No. 14).

**Davenport, Eugene**, American agriculturist and educator: b. Woodland, Mich., 20 June 1856. He was professor of agriculture in the Michigan Agricultural College in 1889-91, and president of the agricultural college at São Paulo, Brazil, in 1891-2. In 1895-1901 he was professor of animal husbandry in the University of Illinois. In September 1901 he became dean of the College of Agriculture of that institution, director of the Agricultural Experiment Station, and professor of thremmatology. He has contributed to the agricultural press and the bulletins of the experiment stations of Illinois and Michigan.

**Davenport, Fanny Lily Gypsy**, American actress: b. London 10 April 1850; d. Duxbury, Mass., 26 Sept. 1898. Her first appearance on the stage was at the Howard Athenæum in Boston, then under the management of her father, E. L. Davenport (q.v.). She played during her career in the theatres of all the large cities in the United States. Her most noted roles were in 'La Tosca,' 'Giaconda,' 'Fedora,' and 'Cleopatra.' She was married in 1879 to Edwin H. Price, but was divorced and subsequently married Melbourne McDowell, an actor of leading roles in her company.

**Davenport, Franklin**, American legislator: b. Philadelphia, Pa.; d. Woodbury, N. J., about 1829. He studied law, and, having been admitted to the bar, practised at Woodbury, N. J. In the Revolution he was a captain of artillery in Newcomb's New Jersey brigade, and also stationed at Fort Mifflin. In 1794, at the time of the "Whiskey Insurrection," he marched with the troops to Pittsburg as colonel of the New Jersey line. He was appointed United States senator to fill a vacancy, serving in 1798-9, and was a representative in Congress in 1799-1801.

**Davenport, Herbert Joseph**, American educator and publicist: b. Wilmington, Vt., 10

Aug. 1861. He was educated at the University of South Dakota, and the Harvard Law School, and is now (1903) principal of the high school at Lincoln, Neb. He has published: 'Outlines of Economic Theory' (1896); 'Elementary Economic Theory' (1898); 'Principles of Grammar' (with Emerson, 1898).

**Davenport, Henry Kallock**, American naval officer: b. Savannah, Ga., 10 Dec. 1820; d. Franzensbad, Bohemia, 18 Aug. 1872. He entered the navy in 1838, and in 1844, as passed midshipman, became connected with the coast survey. In 1849-53 he was in the mail-steamship service, subsequently was on sea duty with various squadrons, and in 1856 participated in the capture of the Barrier forts, Canton River, China. During the Civil War he commanded the steamer Hetzel in 1861-4, being in 1862-4 senior officer in command of the sounds of North Carolina. Promoted captain in 1868, he was assigned to the command of the Congress of the European squadron in 1870.

**Davenport, Homer Calvin**, American artist and cartoonist: b. Silverton, Ore., 8 March 1867. Without schooling or art education, and after many vicissitudes as jockey, circus clown, and railroad stoker, he was employed by the San Francisco *Examiner* in 1892 and since then has been engaged upon the staff of the *American and Journal*, the *World*, and the *Evening Mail* of New York. He has also appeared as a lyceum lecturer. He has published: 'Davenport's Cartoons'; 'The Bell of Silverton, and Other Short Stories of Oregon'; 'The Dollar or the Man.'

**Davenport, Ira**, American politician: b. Hornellsville, N. Y., 28 June 1841. After graduating from Yale College he went into business and in 1877 was elected to the New York senate and re-elected in 1879. During both terms he served as chairman of the committee on commerce and navigation. He was elected comptroller of the State of New York in 1881, and after retiring from that office served two terms as member of Congress. He was the Republican candidate for governor of the State of New York in 1885, but was defeated by D. B. Hill, since which time he has retired from politics.

**Davenport, John**, American Puritan clergyman: b. Coventry, England, 1597; d. Boston, Mass., 15 March 1670. Educated at Oxford, he became chaplain of Hilton Castle, near Durham, later was made minister of Saint Stephen's Church, London (1616-33), and there attained a considerable reputation as a preacher. His Puritanical principles and views ere long brought him into conflict with Archbishop Laud, and in 1633 he withdrew from the English Church, and removed to Holland, where he became colleague of the Rev. John Paget, pastor of the Puritan church at Amsterdam. In 1636, however, he returned to England, where he was very active in obtaining the charter of the Massachusetts colony. He arrived in Boston in June 1637, sat with the synod of Cambridge in August, and in March 1638 sailed with the band of colonists that founded New Haven (Quinnipiac). Here he was extremely influential in civil as well as ecclesiastical affairs. He was minister there for 30 years, and aided in establishing the system of civil polity, which began by the declaration that "all of them would be ordered by the rules which



the Scriptures held forth to them." On 4 June 1649, holding their constituent assembly in a barn, the "free planters" resolved that church members only should be burgesses, and Davenport was chosen one of the "seven pillars" to support the ordinance of civil government. He exhorted the governor to judge justly, and the "cause that is too hard for you to bring it to me." Annual elections were ordained, and God's word established as the only rule in public affairs. In his carefulness in regard to the admission of members to the Church, he held in reality also the keys of all political power. When the messengers of the king, who had come to New England in pursuit of Goffe and Whalley, the regicide judges of Charles I., approached New Haven, he hid the fugitives in his house, and preached to his congregation from Isaiah xvi. 3 and 4: "Hide the outcasts: bewray not him that wandereth. Let mine outcasts dwell with thee, Moab: be thou a covert to them from the face of the spoiler." After the death of Wilson, the pastor in Boston, in 1667, he removed there to succeed him. He was installed in December 1668. His election caused a division in the congregation. Those who opposed his views on the "half-way covenant" withdrew and organized the Old South Church. The controversy went on for many years. Among his publications are: 'Discourse About Civil Government in a New Plantation Whose Design is Religion' (1663); 'The Knowledge of Christ Indispensably Required of All Men Who Would be Saved' (1653); 'A Catechism Containing the Chief Heads of Christian Religion' (with Hooke 1659); 'The Saints' Anchor-Hold' (1661); 'The Power of Congregational Churches Asserted and Vindicated' (1672). He was also an editor of the works of Dr. John Preston, for some time leader of the English Puritans. Consult: Mather, 'Magnalia' (1702), and Dexter, 'Sketch of the Life and Writings of Davenport' ('Papers' of the New Haven Colony Hist. Soc., Vol. II., 1877).

**Davenport, Robert**, English poet and dramatist: flourished about 1623; d. after 1640. He is known only through his 'A Crowne for a Conqueror, and Too Late to Call Backe Yesterday. Two Poems, the One Divine, the Other Morall' (1623); 'King John and Matilda' (1655), a tragedy; and two comedies: 'A New Trick to Cheat the Divell' (1639), and 'The City Night Cap' (printed 1661). That he was associated with Shakespeare in producing parts 1 and 2 of 'Henry VI.' seems established, and it is almost certain that he is the author of a play called 'The Pirate.'

**Davenport Brothers**. IRA E. (b. 1839) and WILLIAM H. (b. 1841). So-called "mediums," who professed to be adepts in spiritistic arts, and who, by their skill in performing various feats and their clever deceptions gained many followers. They flourished in 1845-65, but were finally exposed as impostors: Consult Abbot, 'The Davenport Brothers' (1864) and Barkas, 'Lecture on the Brothers Davenport' (1864). See SPIRITUALISM.

**Davenport, Ia.**, a city of Scott County, of which it is the county-seat, on the western bank of the Mississippi, opposite Rock Island, Ill., 330 miles above Saint Louis, and 184 miles west by south of Chicago; on the Burlington, Cedar

Rapids & Northern, the Chicago, Milwaukee & Saint Paul, the Chicago, Rock Island & Pacific, and other railways. It is pleasantly situated at the foot of the Upper Rapids of the Mississippi, on the slope of a steep bluff which extends for 3 miles along the river and commands an extensive view. It is connected with the Illinois shore by an iron railway and carriage bridge, built in part by the Federal government, and costing \$1,200,000, and an iron railway bridge costing \$800,000. On Rock Island, which is crossed by the former structure, are the central United States arsenal and armory, military headquarters, and other government buildings.

**Industries, etc.**—The census of 1900 shows 416 establishments here, with a capital of \$10,774,707, employing an average number of 4,348 persons at wages amounting to \$1,892,737; cost of materials used, \$6,854,677; value of products, \$11,573,670. The surrounding region is important both agriculturally and for its coal mines. Davenport ships large quantities of farm produce, river-packets from Saint Paul to Saint Louis furnishing means of transportation in addition to that of the railways. The flour and grain business is an important one. Among the numerous manufactured products are lumber and planing-mill products, brick and stone, bread and other bakery products, carriages and wagons, agricultural implements, woolen goods, glucose and its products, foundry and machine-shop products, cordage, pottery, furniture, cigars, and cooperage products. Wholesale slaughtering and meat-packing is also carried on here.

**Public Institutions, Buildings, etc.**—Davenport has an Academy of Natural Sciences, the organization having been begun 14 Dec. 1867; Saint Luke's, Mercy, and other hospitals; a public library; two opera-houses; a Masonic temple, and other important buildings. It is the seat of Saint Ambrose College and other educational institutions, and of the State Orphanage; and it is an episcopal see of the Roman Catholic Church and the Protestant Episcopal Church. The Academy of Natural Sciences regularly publishes 'Proceedings,' and has a large scientific library and a fine collection of mound-builder relics.

**History, Government, etc.**—Davenport was founded in 1835, in the autumn of which year a company, led by Col. George Davenport, long a resident on Rock Island, was formed for the purchase of a site. In 1838 it was incorporated as a town, and in 1851 a city charter was obtained from the legislature and adopted. The Chicago & Rock Island Railway was chartered in 1851 and completed in February 1854. The government is by a mayor, biennially elected, and a city council, comprising the mayor and aldermen elected by wards and at large. The annual income is about \$540,000; the expenditure is \$500,000. Pop. (1890) 26,872; (1900) 35,254.

**Davey, Richard Patrick Boyle**, English journalist: b. 1848. He began his career in 1870 in New York, where he edited 'The Spirit of the Times'; and returning to England in 1880 has since been connected with various London journals as literary and dramatic critic. He has published: 'Sand Sea'; 'A Royal Amour' (1881); 'Weatherleigh' (1894); 'The Sultan and His Subjects' (1895); 'Victoria: Queen and Empress' (1897); 'Mary Tudor' (1898);



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'Cuba: Past and Present' (1898); 'Life of Lady Jane Grey' (1902); 'Historical London' (1902); 'Lucrezia Borgia' (1903). He is also the author of the plays: 'Paul and Virginia' (1886); 'Lesbia' (1889); 'Inheritance,' produced in New York and played 1,500 times; 'St. Ronan's Well' (1893); 'Marion de l'Orme' (1894); and has lectured both in England and the United States.

**David** (Heb. "beloved"), king of Israel. He was the youngest son of Jesse, a citizen of Bethlehem, and member of the tribe of Judah. His life is recorded in the first and second books of Samuel and the first book of Chronicles. The book of Psalms, a large portion of which was composed by him, also contains frequent allusions to incidents in his life, evidently introduced for allegorical purposes, and often supposed to apply prophetically to the Messiah, of whom David was an ancestor. During Saul's life, and in consequence of his disobedience to the divine commands, the prophet Samuel was sent to anoint David, who then kept his father's flocks as king of Israel. David was afterward recommended to Saul for his skill in music, and played before him to soothe a melancholy distemper to which the king was subject. On the breaking out of war he was sent home, but being sent by his father to inquire after his brothers in the army he slew Goliath, a Philistine giant, who had defied the armies of Israel. Saul again took him to court, but exhibited extreme jealousy of him, and frequently tried to kill him. David escaped through the connivance of Jonathan, Saul's eldest son, who had formed a strong attachment for him. He now became the master of a band, composed in great part of lawless characters, but whom he seems to have disciplined and kept in subordination. He was pursued and persecuted by Saul during a great part of the remainder of that monarch's life. On the death of Saul he was crowned king of Judah at Hebron, and seven years afterward, at the close of a successful war with Ishbosheth, Saul's successor, was acknowledged king of all Israel. He reigned after this for 33 years, extending the dominions of the kingdom of Israel by conquests over the Philistines, Amalekites, Edomites, Moabites, Ammonites, and Syrians. Although generally a just and merciful prince, he committed an act of great oppression in taking possession of the wife of Uriah, one of his officers, and directing Joab, the captain of the host, to abandon Uriah at the siege of Rabbah, and permit him to be killed. For this the prophet Nathan predicted great calamities to his family and kingdom, and it was soon followed by the rebellion and death of his favorite son Absalom. Another of his sons, Adonijah, rebelled near the close of his reign. David's penitence for this offense is expressed in several beautiful psalms. He was succeeded by Solomon, his son by Bathsheba, the wife of Uriah. David made great preparations for the building of a temple at Jerusalem, which he had conquered from the Jebusites, but the work was by divine command transferred to his son Solomon, by whom it was carried out. David was born, according to Ussher, 1085 B.C., anointed king 1063, made king of Judah 1055, of Israel 1048, died 1015. Some modern authorities place his death earlier, others later. See **PSALMS**.

**David, Saint** (Welsh, *Dewi*), patron saint of Wales; d. 601. He was archbishop of Caerleon and afterward of Menevia, now Saint David's. He was celebrated for his piety, and many legends are told of his miraculous powers. Several theological treatises are ascribed to him.

**David I.** (often called **St. David**), king of Scotland; b. about 1080; d. Carlisle, England, 24 May 1153. He succeeded his brother, Alexander the Fierce, in 1124. He married Maud, grandniece of William the Conqueror; and was Earl of Northumberland and Huntingdon when called to the Scottish throne. On the death of Henry I., king of England, he maintained the claim of his daughter Maud against King Stephen, and seized Carlisle, but was defeated at the battle of Northallerton in 1138.

**David II.**, king of Scotland; b. Dunfermline, Scotland, 5 March 1324; d. Edinburgh 22 Feb. 1371. He was the son of Robert Bruce (q.v.), and succeeded to the throne in 1329. On the death of his father he was acknowledged by the great part of the nation. Edward Baliol, however, the son of John Baliol, formed a party for the purpose of supporting his pretensions to the crown; he was backed by Edward III. of England. Battles were frequent, and at first Baliol was successful; but eventually David succeeded in driving him from Scotland. Still, however, the war was carried on with England with increasing rancor, till at length David was made prisoner at the battle of Neville's Cross (1346). After being detained in captivity for 11 years he was ransomed for 100,000 marks. The remainder of his reign was occupied in disputes with his parliament.

**David, Armand**, *är'män dä-vêd*, French abbé, naturalist, and missionary; b. Espelette 7 Sept. 1826. He entered the congregation of the Lazarists in 1848, teaching the natural sciences for some time at Savone, and going, in 1862, to China, where he made an enormous collection of plants, minerals and animals, which he sent to the museum in Paris. In 1866 he undertook a new exploration, chiefly through Mongolia and eastern Tibet. In 1872 he made a third voyage to China, lasting two years. Besides the accounts of his journeys, appearing in the archives of the Museum under the title of 'Journal of My Third Voyage of Exploration in the Chinese Empire' (1875), he left many works on natural history, among which are: 'The Birds of China,' and 'Plantæ Davidianæ ex Sinorum Imperio' (1890).

**Da'vid, Christian**, Moravian missionary; b. Sinfleben, Moravia, 31 Dec. 1690; d. Herrnhut 3 Feb. 1751. In 1722 he was the leader of the Moravians who took refuge from persecution with Count Zinzendorf and founded their settlement at Herrnhut. In 1733 he went to Greenland, establishing the first mission there; he later made several visits to Greenland, as well as missionary journeys to Denmark, Holland, Livonia, and England.

**David**, *dä-vêd*, **Félicien Cesar**, French musician and composer; b. Cadenet, Vaucluse, 13 April 1810; d. Saint Germain, near Paris, 29 Aug. 1876. After some vicissitudes he entered the Paris Conservatoire in 1830, and became an ardent disciple of St. Simon, *Enfantin*, and other social speculators. In 1832, with a

few companions, he went to the East in order to realize his dreams of a perfect life, but returned disappointed in 1835. He then published his 'Mélodies Orientales,' and soon after his most successful work, the ode-symphony 'Le Désert' (1844). His other works include many compositions for strings and for the pianoforte, and 'Moïse sur le Sinai' (1846); 'Christophe Colomb' (1847); 'L'Eden' (1848); 'La Perle du Brésil' (1851); 'Herculeum' (1859); and 'Lalla Rookh' (1863). His work abounds in felicitous and melodious expression, and is pre-eminently marked by the qualities characteristic of French music.

**David, dā'vêd, Ferdinand,** German violinist: b. Hamburg 19 Jan. 1810; d. Kloster, Switzerland, 18 July 1873. He was a pupil of Spohr; made his début in 1824; and was leader of Gewandhaus Concerts, Leipzig 1836. His works, which reach Opus 39, are principally for the violin. He was the friend of Mendelssohn and the teacher of Joachim and Wilhelmj.

**David, Gheerardt, gā-rārt' dā'vêd,** Dutch painter: b. Oudewater about 1460; d. Bruges 13 Aug. 1523. In 1484 he entered the Painters' Guild of Bruges, of which he became dean in 1501. The National Gallery, London, contains an admirable example of his work in 'A Canon and His Patron Saints,' a wing from an altarpiece; and among his other pictures are a 'Madonna,' in the museum at Rome; a 'Crucifixion,' in Berlin; and a 'Baptism of Christ,' and a 'Descent from the Cross,' both at Bruges. See Conway, 'Early Flemish Artists' (1887).

**David, Jacques Louis, zhāk loo-ê dā'vêd,** French painter: b. Paris 30 Aug. 1748; d. Brussels 29 Dec. 1825. After obtaining the grand prize in Paris he studied in Rome from 1775 to 1780, devoting himself particularly to historical painting. He visited Rome a second time in 1784, and finished his masterpiece, the 'Oath of the Horatii,' which Louis XVI. had commissioned him to design from a scene in the Horaces of Corneille. In the same year he painted his 'Belisarius'; in 1787, the 'Death of Socrates'; and in 1788, 'Paris and Helen.' He finished, in 1789, a large painting representing Brutus condemning his sons to death. He also furnished the designs of the numerous monuments and republican festivals of that time. In 1792 he was chosen an elector in Paris; afterward a deputy in the National Convention; and during the Reign of Terror was one of the most zealous Jacobins, and wholly devoted to Robespierre. He proposed to erect a colossal monument of the nation on the Pont-Neuf, from the materials of the king's statue. At the trial of Louis XVI. he voted for his death. In 1799 he executed the 'Rape of the Sabine Women,' from the exhibition of which he received, as it is said, 100,000 francs. In 1804 the emperor directed him to execute four pieces, among which the coronation of Napoleon was particularly distinguished. Among his finest works of this period were many representations of the emperor, particularly that in which Napoleon was represented on horseback, on Mount St. Bernard, pointing out to his troops the path to glory. This is often engraved. In 1814 David painted 'Leonidas,' his last painting in Paris. After the second restoration of Louis XVIII. he was included in the decree which banished all regicides from France. He then es-

tablished himself at Brussels, where he died in exile. The opinions of the merits of this artist are various, but the praise of correct delineation and happy coloring is universally conceded to him. He found in the history of his time, in the commotions of which he took an active part, the materials of his representations. See Mather, 'History of Modern Art' (Vol. II. 1896); Stranahan, 'History of French Painting' (1899).

**Da'vid, Laurent Olivier,** Canadian journalist and author: b. Sault au Recollet, Quebec, 24 March 1840. He was educated at the College of Sainte Thérèse, and was admitted to the bar in 1864. He assisted in founding the paper 'Le Colonisateur,' 'L'Opinion Publique,' and the 'Le Bien Publique.' In the latter he attacked the Roman Catholic clergy for their interference in political matters. In 1886 he was elected to the Canadian legislature from East Montreal, but declined re-nomination in 1890. He has written: 'Biographies et Portraits' (1876); 'Les Héros de Chateaugay' (1883); 'Les Patriotes de 1837-8' (1884); 'Les Deux Papineau' (1896); and 'Le Clergé Canadien: sa mission et son œuvre' (1896).

**David, Pierre Jean, pē-ār zhōn,** French sculptor: b. Angers 1789; d. 5 Jan. 1856. He is commonly called **DAVID D'ANGERS**. He became the pupil of J. L. David (q.v.), and his bas-relief of Epaminondas having gained the first prize for sculpture in 1811, he was enabled to go to Rome to perfect himself in his art. On his return to Paris he laid the foundation of his fame by a colossal statue of the great Condé in marble. In August 1826 he was nominated a member of the Academy of Fine Arts, and in December of the same year professor in the School of Painting and Sculpture. He executed busts of Goethe for Weimar, of Schelling for Munich, of Tieck for Dresden, of Rauch and Humboldt for Berlin. In 1831 he began the magnificent sculptures of the Pantheon, his most important work, which he finished in 1837. He executed a great number of medallions, busts, and statues of celebrated persons of all countries, among whom may be named Walter Scott, Canning, Washington, Lafayette, Guttenberg, Cuvier, Victor Hugo, Béranger, Paganini, and Madame de Staël. David worked with great rapidity and ease, and his chief strength consisted in his facility of invention and execution, especially in large works. In works of smaller size his drawing and modeling are seen to be deficient in fineness and accuracy.

**David, dā'vêth',** Colombia, South America, situated on the Isthmus of Panamá, in a fertile plain on the Rio David which enters the Pacific eight miles to the south. Stock-raising and the cultivation of tobacco are extensively engaged in, and there is a considerable trade. Pop. 9,000.

**David Ap Gwilym, dā'vêd āp gwêl'im,** Welsh poet of the 14th century. There is a doubt about his dates, some authorities giving 1340-1400; others 1300-68. He had a good education and considerable knowledge of Italian and Latin. His tendency to keen satire was very unpleasant to his kinsmen and neighbors, and he was at one time forced to leave home on this account. To Morvydd, the lady whom he loved, he addressed nearly 150 poems; though she returned the poet's love she was forced into an

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uncongenial marriage with a wealthy man. David eloped with her, and the fine imposed on him by the husband was so heavy that he could not have paid it but for the assistance of the men of Glamorganshire. Over 250 of his poems were collected and published by Owen Jones (1789); and a translation published by Arthur James Johnes (1834). Others of his poems have been discovered in manuscript.

**David City, Neb.**, the county-seat of Butler County; situated on the Union P., the B. & M., the F. E. & M. V. R.R.'s, and about 45 miles northwest of Lincoln, the capital of the State. It is a trade centre for the populous agricultural region surrounding the city. Pop. 2,000.

**David Balfour; Being Memoirs of His Adventures at Home and Abroad**, a novel by Robert Louis Stevenson, published in 1893. A sequel to 'Kidnapped,' this novel opens with the attempt of David Balfour to effect the escape of his friend, Alan Stewart, from Scotland; and to aid Stewart's brother, unjustly imprisoned on a charge of murder. He falls in love with Catriona Drummond, is imprisoned, and after his release goes to Holland, where he lives with Catriona without marriage. Her father interfering, the two are separated; but by the intervention of Alan Stewart they meet again and are married. The novel is in the romantic vein, written with Stevenson's simplicity and clearness, and is artistic in construction.

**David Copperfield**, a novel by Charles Dickens, which was that author's favorite among his works, and was partly autobiographical in character. It is ranked among the greatest English novels. The hero's career is given from the day of his birth. At 10, he runs away from home, having been forced by a harsh stepfather to undertake rough daily work. He is adopted by his aunt, Miss Betsy Trotwood, an eccentric but kindly woman; and finally becomes an author. After the death of his "child wife," Dora Spenlow, he marries Agnes Wickfield, an almost ideal character.

**Davidge, William Pleater**, American actor: b. London, England, 17 April 1814; d. Cheyenne, Wyo., 7 Aug. 1888. He made his first appearance on the stage at the Drury Lane Theatre in London; after acting in various places in England, came to the United States in 1850. He took the part of Sir Peter Teazle at the old Broadway Theatre in New York, supported Forrest and other leading actors and took part in the Shakespearean revivals at the Winter Garden Theatre in 1867. In 1869-77 he was at Daly's Fifth Avenue Theatre; in 1879 he appeared as the original Dick Deadeye in 'Pinafore'; and in 1885 he became a member of the Madison Square Theatre Company. He played over 1,000 parts, among them Hardcastle in 'The Stoops to Conquer'; Croaker in 'Good Natured Man'; Caliban in 'The Tempest'; Nick Bottom in 'A Midsummer Night's Dream'; and Old Gobbo in 'The Merchant of Venice.'

**Davidists**, the name given to two distinct religious sects, namely, the followers of David of Dinant in the 13th century, and those of David George or Joris in the 16th. David of Dinant was a contemporary of Almaricus of Bena (Amaury de Bène), and at the death of

Amaury (1204) continued to teach Amaury's pantheistic doctrine, founded on Neoplatonism, that the "All is God." David taught that holiness is simply the consciousness of the presence of God, the thought that God is the "One and the All": that he who attains the perfect view of the God-All cannot sin, no matter what enormities he commits; he is the Christ, he is the Holy Ghost. The other sect of Davidists, called also David-Georgians, after the name of their founder, who was born at Delft in 1501, had its rise in 1534. Its founder published in 1542 his 'Book of Wonders,' recounting his marvelous visions and divine revelations. But he retired from the leadership in 1544, and during the remainder of his life was a prosperous merchant at Basel, under an assumed name. By order of the senate of Basel, his body, as that of a heretic, was exhumed and burnt. The sect, with Henry Nicolas as its head, made progress in Holland and got a footing in England, being now known as Familists. The Familists taught as their chief tenet the gospel of love, divine love. Love, they held, is above all laws, whether ceremonial, moral, or civil, and the practice of the sectaries was so consonant with this doctrine that early in the 17th century the societies of Familists had to be suppressed in both countries, by the civil power.

**Davids, Thomas William Rhys**, English Oriental scholar: b. Colchester 12 May 1843. He was educated at the University of Breslau; from 1866 on filled judicial places in Ceylon and acted as archaeological commissioner. In 1877 he was called to the London bar, and subsequently became professor of Pali and Buddhist literature in University College, London. Among his works are: 'Buddhism' (1877); translations of 'Buddhist Birth Stories' (1880); 'Buddhist Suttas' and 'Vinaya Texts' (1891), published in 'The Sacred Books of the East'; 'American Lectures' (1896); 'Sacred Books of the Buddhists; Dialogues of the Buddha' (1899); 'Buddhist India' (1902).

**David's Deer** (*Corvus davidianus*), a deer found in northern China and in Manchuria. It derives its name from Père David, a French Catholic missionary, who first saw it in the imperial park at Peking. It resembles the Indian swamp-deer (q.v.), but has long, shaggy hair. It has no brow-tine. Little is known of its wild habits, for most of the representatives are found in parks and preserves in China or in Europe.

**Davids Island**, an island owned by the United States government and used for military purposes. It is in the waters of Long Island Sound, about 80 rods north of the limits of New York. Area about 100 acres.

**Davidson, George**, American astronomer: b. Nottingham, England, 9 May 1825. He came to the United States in 1832; graduated at the Central High School, Philadelphia, in 1845; and joined the United States Coast Survey. While in this service he was chief engineer of a party which surveyed a ship canal route across the Isthmus of Darien. He also made a geographical survey of the coast of Alaska in 1867. He traveled extensively in Egypt, China, India, and Europe, for purposes of scientific study, and also took charge of the telegraph-longitude work, and of the main triangulation and astronomical party carrying the geodetic work

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across the continent. From 1877-84 he was regent of the University of California, and for many years was president of the California Academy of Sciences. He retired from the coast survey after 50 years of distinguished service, in 1895, and became professor of geography in the University of California.

**Davidson, James Wheeler**, American consul: b. Austin, Minn., 14 June 1872. He was a member of the Peary Arctic expedition to North Greenland 1893-4; war correspondent with the Chinese army 1895; and with the Japanese army 1895-6. In June 1898 he was appointed United States consul for Formosa and Loochoo Islands. He has published: 'Formosa Campaign and Its Future' (1896); 'The Island of Formosa: Past and Present' (1900).

**Davidson, James Wood**, American author: b. Newberry County, S. C., 9 March 1829. He was graduated from South Carolina College (now the State University) and taught Greek at the Mount Zion Collegiate Institute. During the Civil War he fought in the Confederate army as adjutant in Stonewall Jackson's army corps under Lee in Virginia. After the war he took up journalism, living in New York and Washington, and since 1887 has been in the Treasury Department at Washington. He has written: 'The Living Writers of the South' (1869); 'A School History of South Carolina'; 'The Correspondent' (1886); 'The Poetry of the Future' (1888); and 'The Florida of Today' (1889).

**Davidson, John**, Scottish poet, novelist, and miscellaneous writer: b. Barrhead, Renfrewshire, 11 April 1857. He was at first a teacher, but in 1890 went to London and adopted a literary career, writing for the 'Speaker' and other journals. He has published: 'Fleet Street Eclogues' (1893); 'A Random Itinerary' (1894); 'Ballads and Songs' (1894); 'Plays' (1894); 'Earl Lavender' (1895); 'New Ballads' (1896); 'The Last Ballad and Other Poems' (1898); 'The Testament of a Man Forbid' (1901); 'The Testament of an Empire Builder' (1902); and two novels: 'Perfervid' (1890); and 'Baptist Lake' (1894).

**Davidson, John Wynn**, American soldier: b. Fairfax County, Va., 18 Aug. 1824; d. St. Paul, Minn., 26 June 1881. He was a graduate from West Point in 1845; served during the Mexican war in the Army of the West, was then placed on frontier and garrison duty, and fought a battle against the Apache and Utah Indians at Cienguilla, N. Mex., in 1854, in which he lost three fourths of his command. He served in the Federal army during the entire Civil War, and in 1866 became lieutenant-colonel in the United States cavalry. He was professor of military science at the Kansas Agricultural College, and commanded various posts in Idaho, Texas, etc.

**Davidson, Lucretia Maria**, American poet: b. Plattsburg, N. Y., 27 Sept. 1808; d. there 27 Aug. 1825. She was remarkably precocious, and at the age of nine years wrote her first poem, 'Epitaph on a Robin.' In 1829 S. F. B. Morse collected and published her writings under the title 'Amir Khan and Other Poems.'

**Davidson, Margaret Miller**, American poet: b. Plattsburg, N. Y., 26 March 1823; d. Saratoga, N. Y., 1838. She was sister of L. M.

Davidson (q.v.), and began to write at the age of six years. Her poems surpass those of her sister in fervor of sentiment, and flight of imagination. They were published after her decease, with a memoir written by Washington Irving, and met with warm applause both in the United States and England.

**Davidson, Samuel**, Irish biblical scholar: b. near Ballymena, Ireland, 1807; d. 1 April 1898. After entering the ministry of the Presbyterian Church, he became in 1835 professor of biblical criticism and literature in the Presbyterian Theological College in Belfast. He afterward joined the Congregationalists, and was appointed, in 1842, professor of biblical literature and Oriental languages in their college at Manchester, but had later to resign this post owing to his too advanced opinions on theological questions. His works include: 'Sacred Hermeneutics' (1843); 'Translation of Geseler's Ecclesiastical History' (1846); 'The Ecclesiastical Polity of the New Testament' (1848); 'An Introduction to the New Testament' (1848-51); 'Biblical Criticism' (1852); 'Introduction to the Old Testament' (1862); 'Translation of Fürst's Hebrew Lexicon'; 'On a Fresh Revision of the English Old Testament' (1873); 'The New Testament Translated from the Critical Text of Von Tischendorf' (1875); 'Canon of the Bible' (1877); and 'Doctrine of Last Things Contained in the New Testament' (1883).

**Davidson, Thomas**, Scottish philosopher and writer: b. Aberdeenshire 25 Oct. 1840; d. Montreal 14 Sept. 1900. He came to the United States in 1867, and was subsequently professor of classics in the St. Louis High School. In 1875 he settled in Cambridge, Mass. Later he traveled in Greece and Italy, where much of his literary work was perfected. Included in his publications are: 'A Short Account of the Niobe Group' (1874); 'The Place of Art in Education' (1886); 'Giordano Bruno, and the Relation of His Philosophy to Free Thought' (1886); a 'Hand-Book to Dante, from the Italian of Scartazzini, with Notes and Additions' (1887); 'Prolegomena to Tennyson's "In Memoriam"'; 'Aristotle and Ancient and Modern Educational Ideals'; 'The Education of the Greek People and Its Influence on Civilization.'

**Davidson, William**, American general: b. Lancaster County, Pa., 1746; d. Cowan's Ford, N. C., 1 Feb. 1781. He took up arms at the outbreak of the Revolution, was major of one of the first regiments raised in Carolina, was appointed brigadier after the battle of Camden, and in 1781 was despatched by Greene to prevent Cornwallis from passing the Catawba at Cowan's Ford. With his death in the battle which ensued, and with the dispersion of his troops, began the pursuit of Greene by Cornwallis.

**Davidson, William Leslie**, Scottish logician: b. Meikle Wartle, Aberdeenshire, 25 May 1848. He was educated at Aberdeen University, where he has been professor of logic and metaphysics from 1895. He is the author of 'The Logic of Definition' (1885); 'English Words Explained' (1886); 'Theism as Grounded in Human Nature' (1893); 'A Philosophical Centenary' (1896); 'Christian Ethics' (1899).

## DAVIDSON COLLEGE — DAVIESS

**Davidson College**, an educational institution at Davidson, N. C.; founded in 1837, under the auspices of the Presbyterian Church. Its professors and instructors are about 20 in number; students, over 200; volumes in the library, 14,000; value of property, \$300,000; income, about \$20,000.

**Davie, William Richardson**, American soldier: b. England 21 June 1756; d. Camden, S. C., 8 Nov. 1820. He was brought to North Carolina when a child, and was graduated at Princeton, N. J., in 1776. He entered the American army, and obtained a captaincy in Pulaski's Legion. He rose to be colonel and commissary, served throughout the war, and was a favorite officer under Sumter and Greene. He was a member of the convention to form the United States Constitution in 1787, and advocated its acceptance in the convention of North Carolina. Through his influence the University of North Carolina was established. He was elected governor of that State in 1799.

**Davies, dā'vêz, Ben**, English tenor singer: b. 1858. He studied at the Royal Academy of Music; sang for many years with the Carl Rosa Opera Company; sang in Italian opera, and had the title role in 'Ivanhoe.' He also sings in oratorios and concerts, and has several times visited the United States.

**Davies, Charles**, American mathematician: b. Washington, Litchfield County, Conn., 22 Jan. 1798; d. Fishkill Landing, N. Y., 18 Sept. 1876. He was educated at the United States Military Academy and was appointed professor of mathematics there in 1828. He held the same post subsequently at Columbia College and in the University of New York. He published: 'Surveying' (1832); an edition of Legendre's 'Geometry'; and other works and text-books on arithmetic, mathematics, etc.

**Davies, Emily**, English educator: b. Southampton, England, 22 April 1830. She has been identified with the movement for the higher education of women for over 40 years; is life governor of University College, London; honorary secretary of Girton College, Cambridge; and governor of the grammar school, Hitchin. Besides numerous pamphlets, she has published, 'The Higher Education of Women' (1866).

**Davies, Henry Eugene**, American soldier: b. New York 1836; d. 1894. He was admitted to the bar of New York in 1857, and entering the United States volunteers as captain when the Civil War broke out, he became brigadier-general in 1863. Serving with Sheridan he was made major-general of volunteers 1865. He resigned in 1866, afterward practising law in New York. He published 'General Sheridan' in the 'Great Commanders Series' (1895).

**Davies, John**, English poet: b. Hereford about 1565; d. London 1618. He was the author of: 'Microcosmos' (1603); 'The Witte's Pilgrimage'; 'The Scourge of Folly'; 'Wit's Bedlam' (1617); etc.

**Davies, Sir John**, English poet and lawyer: b. Tisbury, Wiltshire, 1569; d. 8 Dec. 1626. He was educated at Westminster and Oxford. Called to the bar in 1595, he became solicitor-general for Ireland in 1603, and attorney-general in 1606, being knighted the next year. He was returned to the English Parliament in 1621, and appointed lord chief justice in 1626.

He wrote: 'Orchestra,' a poem on dancing; 'Hymns to Astraea,' a series of acrostics; 'Nosce Teipsum,' a poem on the immortality of the soul.

**Davies, Sir Louis Henry**, Canadian jurist: b. Charlottetown, Prince Edward Island, 4 May 1845. He was educated at Prince of Wales College in his native town, and was called to the bar of the Inner Temple, London, in 1866. Beginning practice in Charlottetown he rose rapidly, being solicitor-general 1869 and 1871-2, premier and attorney-general of the island 1876-9, and queen's counsel in 1880. He entered the Dominion House of Commons in 1882, remaining a member till his appointment as a judge of the supreme court of Canada. He was knighted in 1897, and was minister of marine and fisheries 1896-1901. In 1898 he was one of the joint high commission on the part of Great Britain for settlement of all differences with the United States respecting Canada, and was joint delegate to Washington with Sir Wilfrid Laurier on the Bering Sea seal question the year previous.

**Davies, Samuel, D.D.**, American clergyman: b. New Castle County, Del., 3 Nov. 1724; d. Princeton, N. J., 4 Feb. 1761. Ordained in 1747, he was at his request appointed to officiate at different places of worship in Hanover County, Va., where, the Episcopal Church being then the established church of Virginia, dissenters were obnoxious to the civil authorities. His labors were highly successful, and led to a controversy between him and the king's attorney-general as to whether the act of toleration which had been passed in England for the relief of Protestant dissenters extended also to Virginia. The ultimate decision of the question was in the affirmative. The first presbytery in Virginia was established through his exertions in 1755; and in 1758 he was chosen to succeed Jonathan Edwards as president of the College of New Jersey. A collection of his sermons was published after his death, in three volumes, and passed through several editions in Great Britain and America.

**Davies, Thomas Alfred**, American military officer and writer: b. Black Lake, St. Lawrence County, N. Y., 3 Dec. 1809; d. there 19 Aug. 1899. He was graduated from West Point in 1829, and became a brevet major-general of volunteers in the Civil War. Among his published works are: 'Cosmogony, or Mysteries of Creation' (1858); 'Genesis Disclosed' (1860); 'Answer to Hugh Miller and Theoretical Geologists' (1861); and 'How to Make Money, and How to Keep It' (1866).

**Davies, Thomas Frederick**, American Protestant Episcopal bishop: b. Fairfield, Conn., 31 Aug. 1831. He was a graduate of Yale in 1853, and subsequently studied at the Berkely Divinity School, where he was for a time professor of Hebrew. He was ordained in 1857, and after being successively rector of St. John's Church, Portsmouth, N. H., and St. Peter's, Philadelphia, was consecrated bishop of Michigan in 1889.

**Daviess, dā'vîs, Joseph Hamilton**, American lawyer: b. Belford County, Va., 4 March 1774; d. Tippecanoe, Ind., 7 Nov. 1811. He was famed for his eccentricities and was commonly known as 'Jo' Daviess. He was ap-



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pointed United States district attorney in Kentucky and in that capacity prosecuted Aaron Burr for treason. Jo Daviess County in Illinois was named in his honor. He was killed at the battle of Tippecanoe.

**Dávila**, dá'vê-lă, the name of several persons well known in the history of Spanish-America: 1. GIL GONZALES. (See CENTRAL AMERICA.) 2. JUAN, Spanish soldier: b. Granada, Nicaragua, 1530; served in Peru, and later under Coronado in Costa Rica, and wrote (1566) 'Relación de la Provincia de Costa Rica,' a document of historical value. 3. COELLO Y PACHECO, governor and captain-general of Chile, 1667-70.

**Davila, Alonzo**, Spanish soldier: b. city of Mexico; d. there 1566. He was supposed to be implicated in a plot to make Martin Cortes ruler of New Spain, and was executed on this account.

**Davila, Enrico Caterino**, ên-rê'ko kă-têr-ê'nô, Italian statesman and historian: b. near Padua, Italy, 30 Oct. 1576; d. near Verona 8 Aug. 1631. His father, a Cypriote, who fled to Venice after the conquest of Cyprus by the Turks in 1561, introduced him to the French court, where he was made page; after this he entered the French service, in which he highly distinguished himself. He subsequently entered the Venetian service, gradually rose to the post of governor of Dalmatia, Friuli, and the island of Candia, and was esteemed at Venice the first man in the republic after the doge. He is principally celebrated for his 'History of the Civil Wars of France, from 1559 to 1598' (Storia della Guerre Civili di Francia, Venice, 1630). This has been translated into several languages, and deserves a place near the works of Guicciardini and Machiavelli.

**Dávila, Pedrarias**, Spanish governor of the Darien colony, Castilla del Oro, and Nicaragua: b. about 1440; d. Leon, Nicaragua, July 1530. His name was originally Pedro Arias, but the form given above is better known in history. He was the brother of the Conde de Puñonrostro, and married the daughter of the Condesa de Moya, the friend of Isabel the Catholic; won distinction in the wars of Granada, and enjoyed the protection of Fonseca, bishop of Burgos, master of the affairs of the Spanish-American colonies during the reigns of Ferdinand and Isabel and Charles I. Fonseca made Dávila governor of Darien in 1514, and the governor promptly employed the adventurers who accompanied him in a number of expeditions, including that of Hernan Ponce and Bartolomé Hurtado (1516) to the coasts of the present republics of Nicaragua and Costa Rica. He established himself at Panama, and had at his command the famous soldiers Balboa, Hernandez de Córdoba, De Soto, Ojeda, Olid, Ponce, and Francisco Pizarro. In 1526-7 he asserted that, as governor of Castilla del Oro, he ought to administer Nicaragua and Honduras as well. His claim to the former was recognized. Balboa suffered death in consequence of incurring his enmity. Pedrarias is cited most frequently as the type of the vigorous, but wholly unscrupulous official of the first period of Spanish colonization on the American mainland.

**Dávila y Padilla**, ê pă thêl yă, **Augustin**, Mexican historian: b. Mexico 1562; d. Santo

Domingo 1604. He entered the order of Dominicans in 1578, taught philosophy and theology at the College of La Puebla and Mexico, becoming prior of his convent La Puebla, and procurer of his order at the courts of Madrid and Rome 1596. He became preacher for Philippe II. 1598, and was consecrated as archbishop of Santo Domingo 1601. He burned several hundred copies of the Bible translated into Spanish and annotated by Protestants. He wrote 'Historia de la provincia de Santiago de Mejico' (1596-1634); and 'Ancient History of the Mexicans.'

**Da Vinci, Leonardo**. See VINCI, LEONARDO DA.

**Davis, Andrew Jackson**, American spiritualist and author: b. Orange County, N. Y., 11 Aug. 1826. He is a resident of Boston, Mass., and the author of more than 30 volumes, chief among which are: 'The Great Harmonia'; 'Harmonial Man'; 'Philosophy of Spiritual Discourse'; 'The Penetralia.'

**Davis, Charles Belmont**, American author: b. Philadelphia, Pa., 24 Jan. 1866. He is a son of Rebecca Harding Davis (q.v.), was educated at Lehigh University, and was United States consul at Florence, Italy, for some time. He has written 'The Borderland of Society.'

**Davis, Charles Henry**, American mathematician: b. Boston 16 Jan. 1807; d. Washington, D. C., 18 Feb. 1877. He entered the United States navy in 1823, served in the Civil War, and became rear admiral in 1863. He made several coast surveys, and wrote: 'Mémorial upon the Geological Action of the Tidal and Other Currents of the Ocean'; and 'The Law of Deposit of the Flood Tide.' He was one of the founders of the 'American Nautical Almanac.'

**Davis, Charles Henry Stanley**, American physician and Egyptologist: b. Goshen, Conn., 2 March 1840. He studied medicine in New York and in European hospitals and subsequently settled in Meriden, Conn., of which he was mayor 1887-8, and city treasurer 1897-9. He has published 'History of Wallingford and Meriden'; 'The Voice as a Musical Instrument'; 'Classification, Education and Training of Feeble Minded, Imbecile and Idiotic Children'; 'The Egyptian Book of the Dead' (edited); 'History of Egypt in the Light of Modern Discoveries'; 'Grammar of the Old Persian Language.' He has been editor of 'Biblia,' a journal of Oriental archaeology, for 14 years and is a member of many learned societies.

**Davis, Cushman Kellogg**, American legislator: b. Henderson, N. Y., 16 June 1838; d. St. Paul, Minn., 27 Nov. 1900. He was graduated at the University of Michigan in 1857; was admitted to the bar, but enlisted in the Union army in 1861. He began the practice of law in St. Paul in 1865; was chosen to the Minnesota legislature in 1867; became United States district attorney in 1868; governor in 1874; and United States senator in 1887, 1893 and 1899. He was a Republican, and a member of the peace commission which negotiated the treaty between Spain and the United States in 1898. He was for several years chairman of the Senate Committee on Foreign Relations, and reported the resolution which practically declared war against Spain.



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**Davis, David**, American jurist: b. Cecil County, Md., 9 March 1815; d. Bloomington, Ill., 26 June 1886. He was graduated at Kenyon College in 1832, and settled in Illinois as a lawyer in 1835. He was elected to the legislature in 1844 and served as a State circuit judge from 1848 to 1862. In the latter year he was appointed an associate justice of the Supreme Court of the United States. He voted in favor of the Legal Tender Act. He resigned in 1877 to enter the United States Senate, of which he became president pro tem. in 1881, and retired in 1883.

**Davis, Edwin Hamilton**, American archaeologist: b. Ross County, Ohio, 22 Jan. 1811; d. New York 15 May 1888. He was the author of 'Ancient Monuments of the Mississippi Valley' (1848), which was described by A. Morlot, the distinguished Swiss archaeologist, as being "as glorious a monument of American science as Bunker Hill is of American bravery."

**Davis, George Royal**, American financier: b. Palmer, Mass., 3 June 1840; d. Chicago 25 Nov. 1899. He enlisted for the Civil War, rising to the rank of colonel, and resigning from the army in 1871. From 1879 to 1885 he was a Republican member of Congress, and served for years on the Republican National Committee. He was director-general of the World's Columbian Exposition, Chicago, in 1893.

**Davis, Henry Gassaway**, American capitalist and legislator: b. Baltimore, Md., 16 Nov. 1823. He became superintendent of the plantation of ex-Gov. George Howard of Maryland, near Woodstock, Md., and subsequently was brakeman and conductor on the Baltimore & Ohio railway, and agent at Piedmont, W. Va. Then he was active as a merchant and collier at Piedmont, and later carried to success the West Virginia Central & Pittsburg Railway, by means of which he gave access to timber and coal lands of great value. The president of this road, he also became president of the Piedmont & Cumberland line. He was elected as a Democrat to the West Virginia House of Delegates in 1865, was State senator in 1867-9, and having served two terms (1871-83) as United States senator, declined re-election. In July 1904 he was nominated by the Democratic party for the vice-presidency of the United States. He was a delegate to the Pan-American congress, and became also a member of the Intercontinental Railway Commission.

**Davis, Henry Winter**, American statesman and orator: b. Annapolis, Md., 16 Aug. 1817; d. Baltimore, Md., 30 Dec. 1865. He was a member of Congress for three terms (1856-65), and took a leading part in advocating emancipation and loyalty to the Union. His published works are: 'The War of Ormuzd and Ahriman in the 19th century' (1853); 'Speeches and Addresses in Congress' (1867).

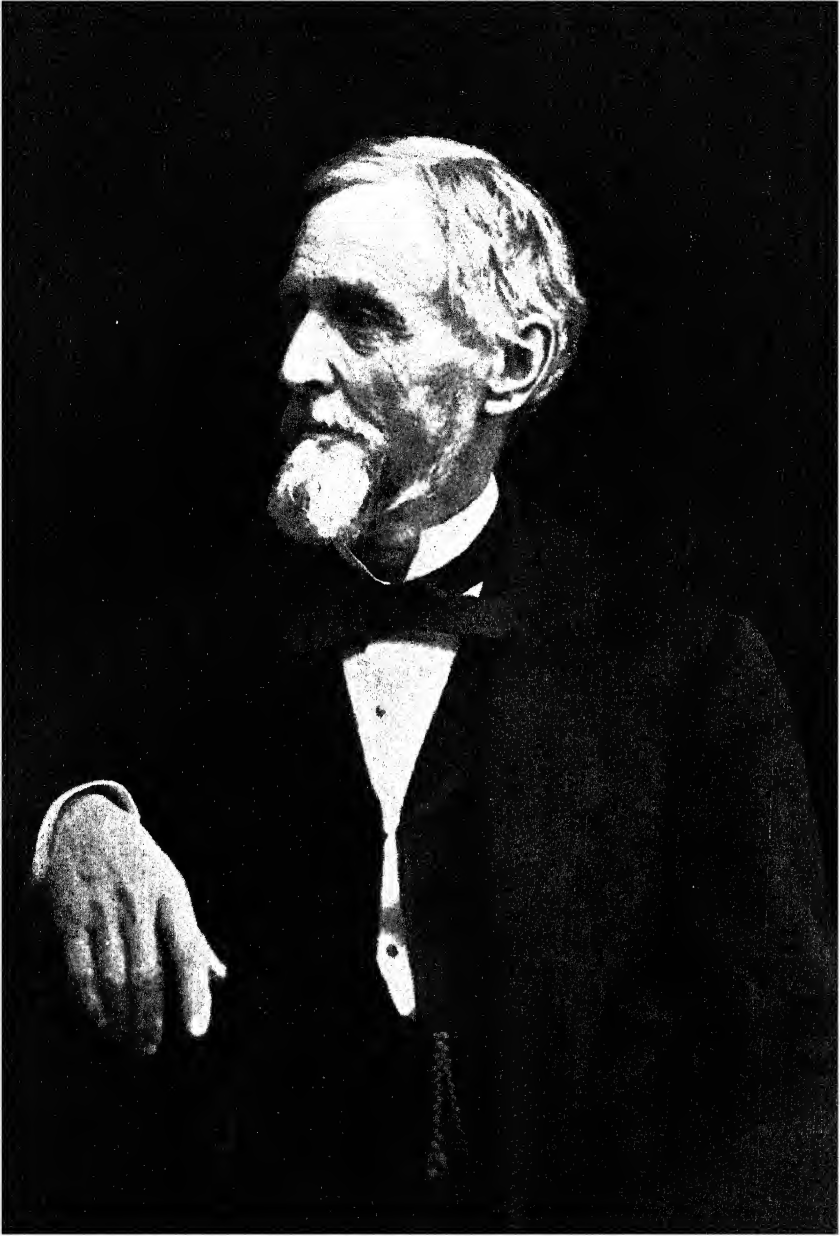
**Davis, Jefferson**, American statesman: b. Abbeville, Christian County, Ky., 3 June 1808; d. New Orleans, La., 6 Dec. 1889. When he was three years old, his father removed with his family to Wilkinson County, Miss. He received an academical education and entered Transylvania University, Lexington, Ky., in 1822, which he left in 1824 to enter the United States Military Academy, from which he was graduated in 1828. He was appointed a second

lieutenant of infantry, and served on the north-western frontier during the Black Hawk war of 1831-2. In 1831 he was promoted to first lieutenant of dragoons for gallantry in action, and was employed in operations against the Pawnees, Comanches, and other Indian tribes. In June 1835, he resigned his commission, and retired to a cotton plantation in Mississippi. He continued in retirement until 1843, when he began to take an interest in politics upon the Democratic side; and in 1844 was chosen a presidential elector. In 1845 he was elected a representative to Congress; but resigned in 1846, having been elected colonel of the First Mississippi Volunteer Regiment of rifles, and served in the Mexican war, greatly distinguishing himself at Monterey and Buena Vista, and being severely wounded in the latter battle. He was appointed a brigadier-general of volunteers by President Polk in 1847, but declined the commission on the grounds that, by the Constitution, the militia appointments were reserved to the States, and that such appointments by the President were in violation of State rights.

The same year he was chosen to fill a vacancy in the United States Senate, and was re-elected by acclamation in 1850 for a full term. In 1853 he was appointed secretary of war by President Pierce, and in 1857, was again elected to the United States Senate, when he took a prominent place among the Southern leaders, and was among the most determined of them all in his assertions of the rights of the States under the Constitution, and also of the right of secession. On 21 Jan. 1861, he took his leave of the Senate in a speech in which he gave his opinion that, by the secession of his State, his connection with that body was terminated, and reaffirmed the doctrine of the right of secession. The Confederate Congress, at Montgomery, Ala., chose him President, under the Provisional Constitution, on 9 Feb. 1861, and he accepted the office on the 16th in a brief address, in which he expressed his desire for the maintenance of peaceful relations with the States which remained in the Union. He asserted that all that the seceding States desired was to be "let alone," but announced that, if war should be forced upon them, they would make the enemies of the South "smell southern powder and feel southern steel."

When Fort Sumter was reduced by the Confederates, and war declared, he found it necessary to put all his previous experience into the immense task of organizing the military resources of the seceding States. He may be said to have created the army, the navy, the arsenals, and all the organization necessary to carry on a war which lasted four years. He bore himself through the varying struggle with untiring energy, and when, in 1865, a feeling of despair spread over the Southern States, he was the last to admit that they had been defeated.

On 17 April, two days after the first proclamation of President Lincoln, he responded by a proclamation authorizing privateering; and on 14 August issued a second one, warning all persons of 14 years and upward, owing allegiance to the United States, to leave the Confederacy within 40 days, or be treated as alien enemies. On 6 November he was chosen permanent President, and was inaugurated 22 Feb. 1862. On 21 May he approved an act in answer to one enacted by the United States



JEFFERSON DAVIS.



## DAVIS

government, providing that all persons owing debts to parties in the North should pay the same into the Confederate treasury. Mr. Davis continued to be President of the southern Confederacy until his capture at Irwinsville, Ga., 10 May 1865, having left Richmond a few hours before Gen. Lee withdrew his troops, and after Gen. Lee's surrender, when he was endeavoring to reach the army of the West. He was conveyed to Fort Monroe, and indicted by the grand jury of the District of Columbia for treason. He was never brought to trial; never asked pardon, and only asked a trial; but, after two years' imprisonment, was released, at the instance of the government, on bail, Horace Greeley becoming one of his sureties. He was included in the General Amnesty Act of Congress, 25 Dec. 1868. In 1871 he had a public reception at Atlanta, Ga., and made a speech in which he reaffirmed his adhesion to the doctrine of State sovereignty. For several years after the war he was president of a southern insurance company and resided in Memphis, Tenn. The last years of his life were spent at Beauvoir, Miss., on an estate that he bought of Mrs. Dorsey before her death. In 1893 amid imposing ceremonies his remains were removed to Richmond, Va., and re-interred in Hollywood cemetery. A number of works have been published on the official life of Mr. Davis, and he himself gives a narrative of the stirring events of 1861-5 in 'The Rise and Fall of the Confederate Government' (1881). A more personal view of the Confederate leader is depicted in 'Jefferson Davis, a Memoir by His Wife' (1890). MRS. JEFFERSON DAVIS.

**Davis, Jefferson Columbus**, American military officer: b. Clark County, Ind., 2 March 1828; d. Chicago, 30 Nov. 1879. He left school for the Mexican war, in which he received a commission for gallantry. He was with the garrison at Fort Sumter, S. C., as first lieutenant when its bombardment began the Civil War. He received the brevet of major-general of volunteers, and the full rank of colonel in the regular army for distinguished service on the Union side during the war. For some years after the war he was stationed on the Pacific coast, and was the first United States army officer to hold command in Alaska, where a new post, Port Davis, was named after him in 1900.

**Davis, Jessie Bartlett**, American contralto singer: b. Morris, near Chicago, 1860. She began her musical career as a church-choir singer; became noted as "Little Buttercup" in 'Pinafore,' presented by the Chicago Church Choir Opera Company 1879, and in 1882 filled the role of Siebel to Adelina Patti's "Margarite," in 'Faust.' She was a pupil of Albiles and later studied a year in Paris with Madame La Grange. She was married to W. J. Davis in 1880, and in 1886 joined the American Opera Company as leading contralto, her husband managing the company. For many years she took leading contralto parts with 'The Bostonians,' achieving great success in "Alan-a-Dale" in 'Robin Hood.'

**Davis, John**, English navigator: b. Sandridge, near Dartmouth, Devonshire, about 1550; d. 30 Dec. 1605. In 1585 he was sent out with two vessels to find a northwest passage, when

he discovered the strait which still bears his name. He afterward explored the coasts of Greenland and Iceland, proceeding as far as lat. 73° N. He made five voyages to the East Indies, on the last of which he was killed in an engagement with some Japanese pirates off the coast of Malacca. He wrote an account of his voyages, and invented a quadrant.

**Davis, John Chandler Bancroft**, American lawyer and diplomatist: b. Worcester, Mass., 29 Dec. 1822. In 1849 he went to London as secretary of the United States legation; in 1854 became American correspondent of the *London Times*, and in 1869, 1871, and 1873-4 was assistant secretary of state. He represented the United States in the "Alabama" contest, zealously pushing the "indirect" claims; was minister to Germany in 1874-7; and judge of the United States court of claims in 1878-82; and became reporter of the United States Supreme Court in 1883. He is the author of: 'The Massachusetts Justice' (1847); 'Mr. Sumner, the Alabama Claims, and their Settlement' (1878); a work published in French entitled 'Process Tribunals of the United States' (1878); and many volumes of United States Supreme Court reports.

**Davis, Mary Evelyn Moore**, American novelist: b. Talladega, Ala., 1852; married Thomas E. Davis in 1874. She has published: 'Minding the Gap and Other Poems'; 'In War Times at La Rose Blanche'; 'Under the Man-Fig' (1895); 'An Elephant's Track and Other Stories'; 'Under Six Flags'; 'The Wire Cutters' (1899); 'The Queen's Garden' (1900); 'Jaconetta.'

**Davis, Matthew L.**, American writer: b. 1766; d. Manhattanville, N. Y., 21 June 1850. He was originally a printer by trade, and acquired in the course of that business a desultory education and considerable skill as a writer. He early attached himself in politics to the fortunes of Aaron Burr, and was an advocate of his elevation to the presidency. For many years he was the correspondent at Washington of the *New York Courier and Enquirer*, under the signature of "The Spy in Washington." For the *London Times* also he wrote under the name of the "Genevise Traveller." During many years before the death of Aaron Burr Mr. Davis was apparently his only attached friend, and the most important of his writings is his 'Memoirs of the Life of Aaron Burr.' Burr's diary was also edited by him.

**Davis, Minnie S.**, American author and lecturer: b. Baltimore, Md., 1835. She was educated at the Green Mountain Liberal Institute, Vermont. After being an invalid for 25 years with spinal disease, she was healed in 1885 by "Mental Science," as she believes, and has since written and lectured upon that topic. Her published books are: 'Marion Lester' (1850); 'Clinton Forest' (1858).

**Davis, Nathan Smith**, American physician: b. Greene, N. Y., 9 Jan. 1817; d. Chicago, Ill., 16 June 1904. He studied medicine and since 1849 has practised his profession in Chicago. He was one of the founders of the Chicago Medical College, now a department of Northwestern University and was a professor there for 30 years, resigning in 1898. He has edited several medical journals and pub-

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lished: 'Principles and Practice of Medicine'; 'Medical Education and Reform'; 'Verdict of Science Concerning the Effects of Alcohol on Man.'

**Davis, Noah**, American lawyer: b. Haverhill, N. H., 10 Sept. 1818. He was admitted to the New York State bar in 1841 and practised for some time in Buffalo. He was justice of the New York supreme court 1857-68, and again 1872-87. The noted cases of Edward Stokes for the murder of James Fisk, Jr., and of William M. Tweed for malfeasance, were tried before him.

**Davis, Noah Knowles**, American philosophical writer: b. Philadelphia, Pa., 15 May 1830. He was educated at Mercer University, Ga., and after holding various educational positions, has been professor of philosophy at the University of Virginia from 1873. He has published: 'The Theory of Thought' (1880); 'Elements of Deductive Logic' (1890); 'Elements of Psychology' (1892); 'Judah's Jewels: a study in the Hebrew Lyrics' (1895); 'Elements of Ethics' (1900); 'Synopsis of Events in Life of Jesus of Nazareth' (1900); 'The Nazarene' (1901).

**Davis, Oscar King**, American journalist: b. Baldwinsville, N. Y., 13 Jan. 1866. He was graduated from Colgate University in 1888 and was a special correspondent for the New York *Sun* and 'Harper's Weekly' at Manila 1898-9, and in China in 1900. He has published: 'Our Conquests in the Pacific.'

**Davis, Rebecca Blaine Harding**, American novelist: b. Washington, Pa., 24 June 1831. She was married to L. C. Davis in 1863. She contributed many short stories and sketches to periodicals, and has written several novels, including: 'Life in the Iron Mills' (1861); 'A Story of To-day' (1861), published later under the title 'Margaret Howth'; and 'A Law Unto Herself' (1878). She was the first writer in this country to introduce the labor question into fiction. Her later works include: 'Waiting for the Verdict'; 'Dallas Galbraith'; 'Natasqua'; 'Frances Waldeaux'; 'Doctor Warrick's Daughters'; 'Silhouettes of American Life.'

**Davis, Richard Harding**, American novelist and litterateur: b. Philadelphia 18 April 1864. He is a son of Rebecca Harding Davis (q.v.). He was graduated at Lehigh University, and entered journalism in Philadelphia. His first purely literary success was the story of 'Gallegher,' based upon his newspaper experiences, and published with other stories in a volume (1891). He has since been constantly engaged in story-writing, and descriptive narration of events, places, and people. Among his works are 'Stories for Boys' (1891); 'The West from a Car Window' (1892); 'Van Bibber and Others' (1892); 'Our English Cousins' (1894); 'The Rulers of the Mediterranean' (1894); 'The Princess Aline' (1895); 'About Paris' (1895); 'Three Gringos in Venezuela and Central America' (1896); 'Soldiers of Fortune' (1897) 'Cuba in War Time' (1898); 'A Year From a Reporter's Note Book' (1898); 'Cinderella, and Other Stories'; 'Exiles'; 'The Lion and the Unicorn' (1899); 'Episodes from a Car Window' (1899) 'With Both Armies in South Africa' (1900). In 1898 he was a war correspondent in Cuba and in 1900 he acted in the same capacity in South Africa.

**Davis, Thomas Osborne**, Irish poet: b. Mallow, County Cork, 14 Oct. 1814; d. Dublin, 16 Sept. 1845. His verse was mainly on patriotic themes, and appears, collected, in Duffy's 'Library of Ireland.'

**Davis, Val**, English artist: b. Liverpool, England, 1854. He studied art under his father, William Davis, a painter of some note, and under Ford Madox Brown, and has exhibited at the Royal Academy almost continuously from 1875.

**Davis, Varina Anne Jefferson**, American novelist: b. Richmond, Va., 27 June 1804; d. Narragansett Pier, R. I., 18 Sept. 1898. She was called "the Daughter of the Confederacy," her father being Jefferson Davis, the President of the Confederate States. Her education was obtained partly in the United States and partly in Germany and France, and she wrote 'The Veiled Doctor,' a novel, and 'A Romance of Summer Seas.'

**Davis, Varina Howell Jefferson**, American writer: b. Vicksburg, Miss., 7 May 1826. She was the second wife of Jefferson Davis (q.v.), to whom she was married in Natchez, 26 Feb. 1845. She was her husband's amanuensis when he wrote his 'Decline and Fall of the Confederate Government' and is the author of 'Jefferson Davis: a Memoir, by His Wife' (1890).

**Davis, William Morris**, American geologist and meteorologist: b. Philadelphia, Pa., 12 Feb. 1850. He has been professor of geology at Harvard University from 1890 and has published 'Elementary Meteorology'; 'Physical Geography'; 'Whirlwinds, Cyclones and Tornadoes' (1884), and many professional papers.

**Davis, William Thomas**, American lawyer and author: b. Plymouth, Mass., 3 March 1822. He was educated at Harvard and was admitted to the bar in 1849. He was at the head of the government of his native town for many years, and has published 'History of Plymouth'; 'Ancient Landmarks of Plymouth'; 'History of the Bench and Bar of Massachusetts'; etc.

**Davis, William Watts Hart**, American writer: b. Southampton, Bucks County, Pa., 27 July 1820. He was graduated at Norwich University in 1842; was instructor in the military academy at Portsmouth, Va., in 1842, and was admitted to the bar in 1845. He served in the Mexican war and was mustered out as captain in 1848. Removing to New Mexico he was United States district attorney, attorney-general, secretary of the treasury, acting governor, superintendent of Indian affairs and superintendent of public buildings, beside publishing the *Santa Fe Gazette* for two or three years. He attained the rank of brevet brigadier-general in the civil war between the States, was twice defeated as Democratic nominee for Congress, and was United States commissioner to the Paris Exposition in 1878. He has published 'El Gringo: or New Mexico and Her People'; 'Spanish Conquest of New Mexico'; 'History of Bucks County'; etc.

**Davis Strait**, a strait on the west coast of Greenland, which connects Baffin Bay with the Atlantic Ocean. At its narrowest point, immediately north of the Arctic circle, it measures about 200 miles across. In 1888 the identity between Ginnunga Gap, referred to in the Sagas, and the present Davis Strait, was demonstrated. See DAVIS, JOHN.

**Davit.** (1) A beam projecting from a ship's bow, for the attachment of the tackle whereby the anchor-fluke is lifted without dragging against the side of the vessel. The operation is nautically called "fishing the anchor." (2) One of a pair of cranes on the gunwale of a ship, from which are suspended the quarter or other boats. The boat-tackles are attached to rings in the bow and stern of the boat respectively, and the fall is belayed on deck. When the boat is lowered the hooks of the fall-blocks are cast off simultaneously, or great danger results when the ship is under way.

**Davitt, Michael**, Irish political leader: b. near Straid, County Mayo, 25 March 1846. Evicted from their small holding, the family emigrated to Haslingden in Lancashire (1851). In 1866 he joined the Fenian movement, the result being that he was sentenced in 1870 to 15 years' penal servitude. He was released in 1877; and, supplied with funds from the United States, began some two years later an anti-landlord crusade in Ireland, which culminated in the foundation of the Irish Land League (21 Oct. 1879). Davitt was thenceforward in frequent collision with the government, and from February 1881, to May, 1882, was imprisoned in Portland for breaking his ticket-of-leave. His 'Leaves from a Prison Diary' were published in 1885. Other works by him are: 'Defence of the Land League' (1891); 'Life and Progress in Australia' (1898); 'The Boer Fight for Freedom' (1902). The views of the "Father of the Land League" on the subject of land therein take a Socialistic form, and accordingly, though a strong Home Ruler, on the question of land nationalization he found himself in opposition to the Parnellites. After the split in the party, he opposed the continued leadership of Mr. Parnell, and was returned to Parliament in 1892 as an anti-Parnellite, but unseated on petition, on the ground of clerical and other intimidation. He was returned unopposed for South Mayo in 1895, resigning in 1899.

**Da'vium.** See DAVYUM.

**Davos**, dā'vōs, a valley and district of Switzerland in the canton of Grisons, lying at a considerable elevation among the Alps, and now a favorite place of residence both in summer and winter for people troubled with tuberculosis. The valley is about 10 miles long, shut in by mountains from 6,000 to 10,000 feet high, and exhibiting many picturesque features. The chief centre of population is Davos-Platz, a place of 5,000 inhabitants, containing numerous hotels, boarding-houses, and other establishments for visitors, and having a handsome town-house, and an English church. It is well sheltered on the north and east, and the air is remarkably pure and dry.

**Davout, Louis Nicolas**, loo-ē nīk-ō-lā dā-voo, marshal of France: b. Annoux 10 May 1770; d. Paris, 1 June 1823. He entered the army in 1785, took sides with the revolutionists, fought several battles under Dumouriez, and was made a brigadier-general in 1793. He accompanied Napoleon in his Italian campaigns and in his expedition to Egypt. In 1804 he was made a marshal of the empire. The victories of Ulm and Austerlitz were mainly due to him, as also those of Eckmühl and Wagram. For these meritorious services he was created Duke of Auerstadt and Prince of Eckmühl. After the retreat from

Moscow he defended Hamburg against all the forces of the allies, and surrendered only after the peace of 1814. When Napoleon returned from Elba, Davout was appointed his minister of war. After the battle of Waterloo he lived in retirement till 1819, when he took his seat in the Chamber of Peers.

**Davy, Sir Humphry**, English chemist: b. Penzance, Cornwall, 17 Dec. 1778; d. Geneva, Switzerland, 29 May 1829. A taste for chemistry, which he displayed in some experiments on the air contained in sea-weed, attracted the attention of Mr. Gilbert, president of the Royal Society, and Dr. Beddoes, and the latter offered him the place of assistant in his laboratory. Here Davy discovered the respirability and exhilarating effect of the nitrous oxide. He published the results of his experiments, under the title of 'Chemical and Philosophical Researches' (1800). This work immediately obtained him the place of professor of chemistry in the Royal Institution, at the age of 22. In 1803 he was chosen a member of the Royal Society. His lectures at the Royal Institution were attended by crowded and brilliant audiences, attracted by the novelty and variety of his experiments, the eloquence of his discourses, and the clearness of his exposition. His discoveries with the galvanic battery, his decomposition of the earths and alkalies and ascertaining their metallic bases, his demonstration of the true nature of oxymuriatic acid, his discovery of chlorine as an element, etc., obtained him a European reputation; and in 1808 he received the Napoleon prize of the French Institute. In 1812 he was knighted. In 1813 appeared his valuable 'Elements of Agricultural Chemistry.' The numerous accidents arising from fire-damp in mines led him to enter upon a series of experiments on the nature of this explosive gas, the result of which was the invention of his safety-lamp (1815). In 1818 he received a baronetcy. In 1820 he succeeded Sir J. Banks as president of the Royal Society. Near the close of his life he wrote his 'Salmonia, or Days of Fly-fishing'; and his 'Consolations in Travel, or the Last Days of a Philosopher.' Besides the works already mentioned, he also wrote: 'Elements of Chemical Philosophy' (1802); 'Bakerian Lectures' (1807-11); 'On the Safety-lamp' (1818); etc. A statue was erected to him at Penzance in 1872.

**Davy, John**, English composer: b. Upton-Helion, Exeter, 1765; d. London 22 Feb. 1824. He was a teacher of music in London and wrote music for popular songs. His air, 'The Bay of Biscay, Oh!' is famous.

**Davy Jones**, a sailor's familiar name for a malignant sea-spirit or the devil generally. The common phrase "Davy Jones' locker" is applied to the ocean as the grave of men drowned at sea. A very dubious explanation of the name makes it compounded from Duffy, a West Indian negro spirit name, and the scriptural prophet Jonah, in jocular allusion to his somewhat unusual adventure.

**Davy Lamp**, the safety-lamp of Sir Humphry Davy, in which a wire-gauze envelope covers the flame-chamber and prevents the passage of flame outward to the explosive atmosphere of the mine, while it allows circulation of air.



## DAVYUM — DAWSON

**Davyum**, or **Davium** (named in honor of Sir Humphry Davy), a substance observed by Kern, in June 1877, in certain Russian ores of platinum, and believed by him to be a metallic element. It is hard, infusible, malleable at a red heat, silvery in lustre, and soluble readily in aqua regia and feebly in boiling sulphuric acid. Mallet (Am. Chem. Jour., Vol. XX., p. 776) has shown that davium is not an element, but that it consists of a mixture of zircon, osmium, iridium, and finely divided quartz.

**Daw.** See JACKDAW.

**Dawalla** (*Hypophthalmus dawalla*), a fish of the family *Siluridae*, found in the rivers of Guiana, and highly esteemed for the delicacy of its flesh. It is sometimes two and a half feet long, and is brightly colored. The eye is situated below the angle of the mouth.

**Dawant, Albert Pierre**, äl-bär pē-är dā-vān, French historical painter: b. Paris 21 Sept. 1852. He was a pupil of J. P. Laurens. He took a medal of the third class 1880, and second class 1885. Among his works are: 'St. Thomas à Becket' (1879); 'Henry IV. of Germany Before Pope Gregory VII.' (1880); 'Last Moments of Charles II. of Spain' (1881); 'Burial of an Invalid' (1882); 'Salute to the Invalides' (1884); 'St. John the Hospitaller' (1885); 'Embarking of Emigrants'; and 'The Rescue' (1889); 'In Alsace' (1892); 'Teaching the Children' (1888), in the Luxembourg Museum; 'End of the Mass' (1890); 'A Rehearsal' (1894); 'Marshall Lannes at Convent of St. Pollen' (1895); 'The Captive' (1896).

**Dawe, Carlton**, English novelist. He has written: 'Mount Desolation'; 'The Emu's Head'; 'Yellow and White'; 'Kakemonos'; 'Captain Castle'; 'The Voyage of the Pulo Way'; 'A Bride of Japan'; 'The Mandarin'; 'Rose and Chrysanthemum'; 'The Yellow Man'; 'Claudia Pole'; 'Straws in the Wind'; 'The Demagogue.'

**Dawes, Anne Laurens**, American writer: b. North Adams, Mass., 14 May 1851. She is the daughter of H. L. Dawes (q.v.) and has been Washington correspondent of several New England papers, besides being prominent in various philanthropic and other organizations. She is the author of 'How We are Governed' (1885); 'The Modern Jew: His Present and Future' (1886); 'Explanation of the Constitution and Government of the United States' (1895); 'Charles Sumner' (1892).

**Dawes, Charles Gates**, American financier: b. Marietta, Ohio, 27 Aug. 1865. He was educated at Marietta College and the Cincinnati Law School, was for some time engaged in civil engineering, and practised law in Lincoln, Neb., 1887-94. He was active in Republican politics, and in 1897 became comptroller of the treasury. He is the author of 'The Banking Systems of the United States.'

**Dawes, Henry Laurens**, American legislator: b. Cummington, Mass., 30 Oct. 1816; d. Pittsfield, Mass., 5 Feb. 1903. He was graduated at Yale in 1839. Becoming a lawyer, he entered the State Senate as a Republican and in 1857 was elected to Congress, serving in the House until 1873. He was elected to the United States Senate in 1875, and was re-elected in 1881 and 1887. The condition of the Indian tribes especially claimed his attention, and after

his retirement from Congress he was at the head of the Commission to the Five Civilized Tribes.

**Dawes, Rufus**, American poet: b. Boston 26 Jan. 1803; d. Washington, D. C., 30 Nov. 1859. He wrote 'The Valley of the Nashaway, and Other Poems' (1830); 'Geraldine' (1839), resembling 'Don Juan' in form and treatment; the successful romance 'Nix's Mate' (1840). His verses were sung at the laying of the corner-stone of Bunker Hill monument.

**Dawes, William Rutter**, English astronomer: b. London 19 March 1799; d. Haddenham, Buckinghamshire 15 Feb. 1868. He is principally celebrated for his accurate measurements of double stars and for his investigation into the minute details of the solar surface.

**Dawes' Holes**, minute circular spots on the nucleus of a sun-spot, darker than the rest of the nucleus, and supposed to be the mouths of tubular orifices penetrating to unknown depths. They were first observed by the astronomer whose name they bear.

**Dawk**, or **Dak**, a term in India for postal traveling arrangements, as by palanquins or other carriages.

**Dawkins, John.** See ARTFUL DODGER, THE.

**Dawkins, William Boyd**, English geologist: b. Buttington, near Welshpool, Montgomeryshire, 26 Dec. 1838. In 1862 he joined the Geological Survey, became curator of Manchester Museum in 1869, and professor of geology in Owens College there in 1874. In 1882 he presided over the anthropological section at the Southampton meeting of the British Association. The Channel Tunnel Committee employed him in 1882 to make a special survey of both coasts, and next year he laid down the line for a tunnel under the Humber. He is a Fellow of the Royal and other learned societies, and has contributed numerous papers to their issues relating especially to fossil mammalia. His chief works are: 'Cave-hunting; Researches on the Evidences of Caves Respecting the Early Inhabitants of Europe' (1874); 'Early Man in Britain, and His Place in the Tertiary Period' (1880); the latter a work of great interest; 'British Pleistocene Mammalia' (1866-87).

**Dawlish**, dā'lish, popular watering place in Devonshire, England, situated at the entrance of a valley which extends inland from the English Channel, between the mouths of the Teign and Exe. Its genial climate, its bathing facilities, and other attractions render it a place of great resort. Pop. (1901) 4,003.

**Dawson, Alec John**, English novelist and traveler: b. Wandsworth, England, 1871. He has traveled extensively in the South Seas, Africa, South America, etc., and is the author of 'Middle Greyness'; 'Mere Sentiment'; 'Lee-way'; 'God's Foundling'; 'The African Nights' Entertainments'; 'Bismillah'; 'In the Bight of Benin'; 'Daniel Whyte'; 'The Story of Ronald Kestrel'; 'Joseph Klassin: Half Caste.'

**Dawson, George Mercer**, Canadian geologist: b. Pictou, Nova Scotia, 1 Aug. 1849; d. 1901. He was a son of Sir J. W. Dawson (q.v.) and was educated at McGill University and at the Royal School of Mines in London. In 1874 he was made assistant director

and in 1895 director of the Geological Survey of Canada. He was the author of 'Geology and Resources of the Forty-ninth Parallel,' and similar works.

**Dawson, Henry**, English landscape painter: b. Hull 3 April 1811; d. Chiswick 13 Dec. 1878. In early life he was a worker in a Nottingham lace-factory, but this occupation he gave up for art in 1835. After struggling some time at Nottingham he removed to Liverpool in 1844, and thence to Croydon in 1850, and subsequently he resided at Chiswick. It was long before his abilities were fully recognized, and his pictures began to bring high prices only a little before his death. Among the best of them are 'Wooden Walls of Old England'; 'London from Greenwich Hill'; 'Houses of Parliament'; 'The Rainbow'; 'Rainbow at Sea'; 'The Pool Below London Bridge.'

**Dawson, Sir John William**, Canadian geologist: b. Pictou, Nova Scotia, 13 Oct. 1820; d. Montreal 19 Nov. 1899. He was educated at Edinburgh University, and early turned his attention to geology. He accompanied Sir Charles Lyell when examining the geology of Nova Scotia in 1842. In 1850 he became superintendent of education for Nova Scotia, and in 1855 principal and professor of natural history in McGill College, Montreal, in which position, as well as in that of vice-chancellor, and latterly principal of the university (1855-93), his services in the cause of education were of very great importance. He became a member of the Royal Society (London) in 1862, was knighted in 1885, and was president of the British Association in 1886 during its meeting at Birmingham. His published works include: 'Acadian Geology' (1855); 'Archæia, or Studies of the Narrative of Creation in Genesis' (1857); 'Agriculture for Schools' (1864); 'Handbook of Canadian Zoology' (1871); 'The Story of Earth and Man' (1872); 'The Origin of the World' (1878); 'The Chain of Life in Geological Time' (1881); 'The Geological History of Plants' (1888); 'Modern Science in Bible Lands' (1888); 'Handbook of Canadian Geology' (1889); 'Modern Ideas of Evolution' (1890); 'The Ice Age in Canada' (1894).

**Dawson, Miles Menander**, American actuary and author: b. Viroqua, Wis., 13 May 1863. He has published: 'Elements of Life Insurance' (1892); 'American Life Insurance Methods' (1893); 'Assessment Life Insurance' (1895); 'Lessons in Actuarial Science' (1897); 'American Experience' (1900); 'Things Agents Should Know' (1900); etc.

**Dawson, William James**, English poet, novelist, and clergyman: b. Towcester, Northamptonshire, 21 Nov. 1854. He entered the Wesleyan ministry in 1875 and held various Wesleyan pastorates until 1892, when he became pastor of the Highbury Quadrant Congregational Church, London. His works include: 'Arvalon: a First Poem' (1878); 'A Vision of Souls' (1884); 'Quest and Visions: Essays on Life and Liberation' (1886); 'The Threshold of Manhood' (1889); 'The Makers of Modern Poetry' (1890); 'The Redemption of Edward Strahan: a Social Story' (1891); 'Poems and Lyrics' (1893); 'London Idylls' (1895); 'The Comrade-Christ: Sermons' (1894); 'The Story of Hannah' (1896); 'The House of Dreams' (1897); 'Through Lattice Windows' (1897);

'Table Talk With Young Men' (1898); 'Judith Boldero, a Tragic Romance' (1898); 'Makers of Modern Prose' (1899); 'Savonarola: a Drama' (1900); 'The Man Christ Jesus' (1901).

**Dawson, Canada**, a mining city and the capital of the Yukon District, Northwest Territories. It is situated at the junction of the Klondike and Yukon rivers, about 50 miles from the Alaskan boundary; in lat. about 64° N. and lon. 139° W. The houses are, many of them, rude structures, but some well-built residences have been erected. The city has churches, schools, banks, hotels, newspapers, theatres, stores, and an electric light plant. Forty below zero is the average temperature for days at a time, but blizzards are not common. Thawing the ground by steam, the use of automatic lifts and buckets, and many other improvements have made mining less laborious and more profitable than when Dawson was first settled, 16 Aug. 1896. Coal deposits have been found nearby, and many of the streams have been bridged by the Canadian government, so that all creeks and other waterways for 40 miles around are connected with Dawson. Pop. 10,000.

**Dax, daks**, a town of France, department of Landes, on the left bank of the Adour. It consists of the town proper, surrounded by old ramparts partly Roman, and of a suburb called Sablar, on the opposite side of the river and communicating with it by a bridge. The principal edifices are the high church, once a cathedral, the bishop's palace, now occupied as public offices, the communal college, normal school, assembly-room, handsome thermal establishment, etc. There are various ancient Roman remains. The chief attraction of the place is its warm sulphur springs, which have temperatures varying from 86° to 166° F., were much frequented the Romans, and are still in great repute for the cure of rheumatic and similar complaints. Its old name was *Aquæ Tarbellicæ*, and from *Aquæ* ("waters") comes its modern name. Pop. (1896) 8,307.

**Day, Benjamin Franklin**, American naval officer: b. Ohio. He was educated at the Naval Academy 1858-61, served in various capacities during the Civil War and became a rear admiral in March 1899, retiring in March 1900.

**Day, George Edward**, American Hebrew scholar: b. Pittsfield, Mass., 19 March 1815. He was educated at Yale and the Yale Theological Seminary, and entering the Congregational ministry was successively pastor at Marlborough and Northampton, Mass., 1840-51. He was professor of biblical literature at Lane Theological Seminary, Cincinnati, 1851-96, and of Hebrew at Yale 1866-95, and professor emeritus from the last named year.

**Day, Henry Noble**, American educator: b. Washington, Conn., 4 Aug. 1808; d. New Haven, Conn., 12 Jan. 1890. He was a nephew of Jeremiah Day (q.v.) and became professor of sacred rhetoric in Western Reserve College in 1830, and was president of the Ohio Female College in 1854-64. He published: 'The Art of Elocution' (1844); 'The Art of Rhetoric' (1850); 'Elements of Logic' (1867); 'The Science of Aesthetics' (1872); 'The Science of Thought' (1886); 'Elements of Mental Science' (1889).

**Day, Holman F.**, American journalist and poet: b. Vassalboro, Me., 6 Nov. 1865. He was graduated at Colby College in 1887 and entering journalism the year after, has since been editorially connected with various Maine journals. He has contributed extensively to periodicals and is the author of two volumes of popular verse: 'Up in Maine' (1900); 'Pine Tree Ballads' (1902).

**Day, Horace H.**, American manufacturer: b. 1813; d. Manchester, N. H., 23 Aug. 1878. He early entered the rubber industry, but was compelled to retire from it as a result of patent litigations with the Goodyear interests. In 1856 he had begun to advocate the utilization of the water power of Niagara Falls, a project, however, in which he expended large sums without return. He returned to the rubber industry, but ultimately lost his fortune.

**Day, James Roscoe**, American Methodist clergyman: b. Whitneyville, Md., 17 Oct. 1845. He was graduated from Bowdoin College in 1874, entered the Methodist ministry and was successively pastor in Portland, Boston, and New York. He is at present (1903) chancellor of Syracuse University.

**Day, Jeremiah**, American educator: b. New Preston, Conn., 3 Aug. 1773; d. New Haven, Conn., 22 Aug. 1867. He was graduated at Yale 1795. Having early made choice of the profession of theology, while acting as tutor he began to preach as a candidate for the ministry; but before taking charge of any parish, was in 1801 elected to the professorship of mathematics in Yale College. In 1817 he became president of the college, continuing in that position till his resignation in 1846. He published: 'An Introduction to Algebra' (1814); 'Navigation and Surveying' (1817); and other works.

**Day, John**, English dramatist: fl. about 1600. Of his life hardly anything is known. He is mentioned in Henslowe's 'Diary' in 1598 as an active playwright. But few of his earlier works have come down to us save 'The Blind Beggar of Bethnal Green.' Day collaborated freely with contemporary writers, as Chettle and Dekker. Ben Jonson in his conversations with Drummond of Hawthornden grouped him with some other admirable gentlemen and authors as a rogue and a base fellow. His best works that have reached us are a graceful comedy, 'Humor out of Breath'; and 'The Parliament of Bees,' a kind of allegorical masque in which all the characters are bees. "The very air," says Charles Lamb, "seems replete with humming and buzzing melodies. Surely bees were never so berhymed before." An edition of Day's works was privately printed by A. H. Bullen in 1881.

**Day, Lewis Foreman**, English decorative artist: b. London 1845. He was trained in the workshops of Clayton and Bell and for 30 years has designed wall decorations, textiles, glass, and various other manufactures connected with ornament. He has lectured on art topics frequently at the South Kensington Art Museum, and is the author of 'Principles of Everyday Art'; 'Nature in Ornament'; 'Stained Glass Windows'; 'Art in Needlework'; 'Alphabets Old and New'; 'Lettering in Ornament'; 'Text Books of Ornamental Design' (4 vols.).

**Day, Richard Edwin**, American journalist and poet: b. West Granby, Oswego County,

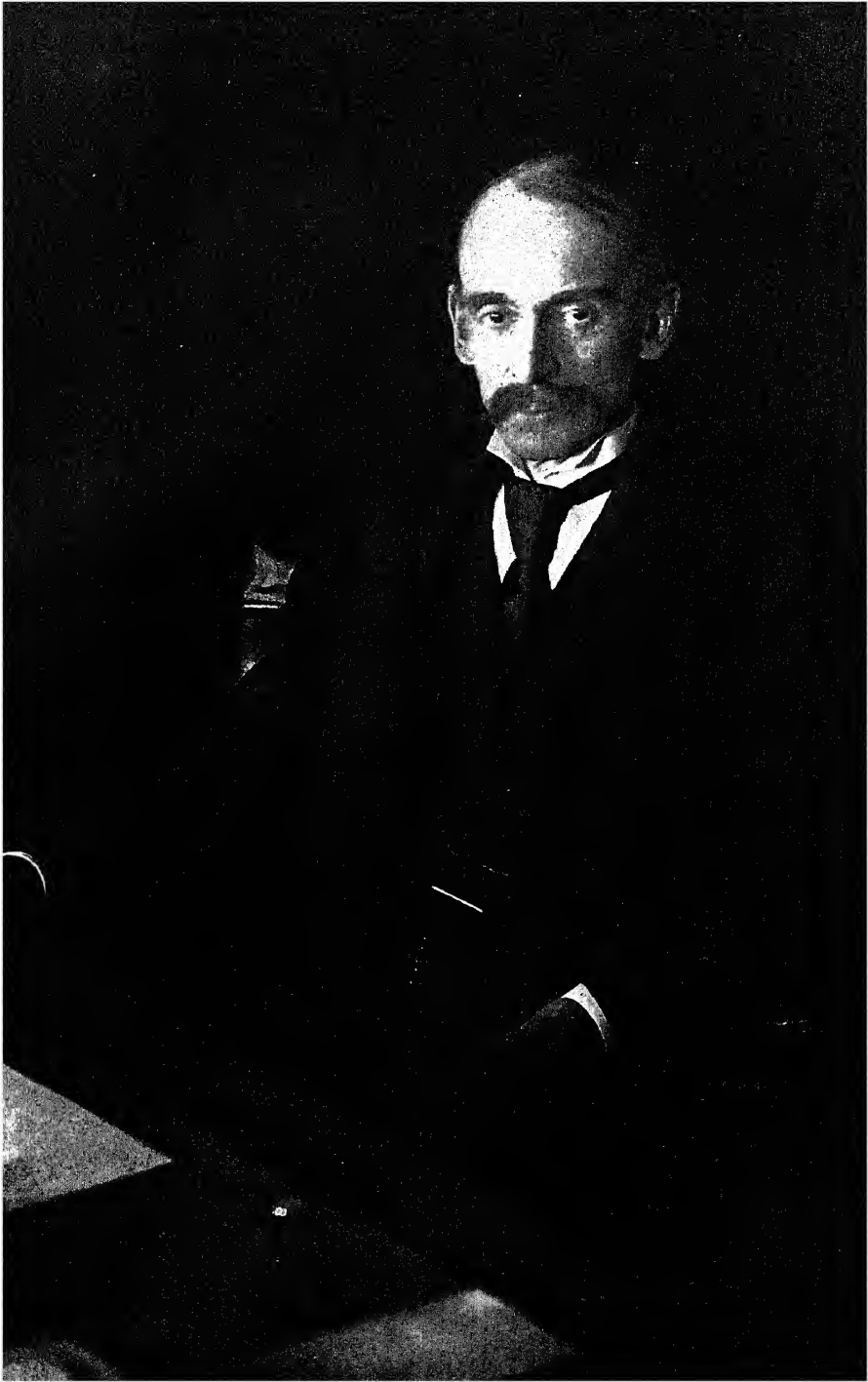
N. Y., 27 April 1852. He was educated at Syracuse University and was on the editorial staff of the *Syracuse Standard* 18 years. He has published: 'Lines in the Sand' (1878); 'Thor: a Drama' (1880); 'Lyrics and Satires' (1883); 'Poems' (1888).

**Day, or Daye, Stephen**, American colonial printer: b. London about 1610; d. Cambridge, Mass., 22 Dec. 1668. He was employed by the Rev. Joseph Glover to accompany him to America in 1638, to operate a printing press which he was going to set up in Massachusetts. Mr. Glover died on the voyage and the press was placed in the house of Rev. Henry Dunster, first president of Harvard College. The first book printed in the colonies was issued from it in 1640, and was entitled 'The Whole Booke of Psalmes, faithfully translated into English metre,' commonly styled 'The Bay Psalm Book.' The printing house was taken from him about 1648, and put into the hands of Samuel Green. See Thomas, 'History of Printing in America' (1810).

**Day, Thomas**, English writer: b. London 22 June 1748; d. 28 Sept. 1789. He was educated at Oxford, and was called to the bar but never practised. In 1778 he married a Miss Esther Milnes, who was willing to conform to his ascetic requirements. His principles led him to renounce most of the indulgences of a man of fortune that he might bestow his superfluities upon those who wanted necessities. He wrote, in prose and verse, on various subjects, but his name is kept alive chiefly by the well-known book written for the young, entitled 'History of Sandford and Merton.'

**Day, William Rufus**, American jurist: b. Ravenna, O., 17 April 1849. He was graduated from the University of Michigan in 1870, and from the law school of the same institution in 1872. In the latter year he was admitted to the Ohio bar, and began the practice of law at Canton, where he soon gained local and state distinction; in 1886 he was elected judge of the common pleas court of the 9th judicial district, being the candidate of both political parties. In 1889, President Harrison appointed him United States district judge for the northern district of Ohio, but he was obliged to decline the appointment on account of ill health. In 1897 he was made assistant secretary of state by his friend, President McKinley, and in April 1898 he succeeded Sherman as secretary of state, as such conducting all the negotiations of the Spanish war. Later in 1898 he resigned the secretaryship, and was appointed chairman of the United States Peace Commission to frame a treaty of peace with Spain, in which capacity he had a conspicuous and responsible part in all peace negotiations. He then returned to his law practice, but in 1899 was appointed to succeed Judge Taft as United States circuit judge, and on 26 Jan. 1903 was appointed to the Supreme Court by President Roosevelt.

**Day**, a word used with several different senses. Its most ancient meaning is the period of light ("natural day") as opposed to the period of darkness, and in this sense it is still quite commonly used. Its most common application, however, is to the period of light and that of darkness together, but even in this sense there are different days. The sidereal day is the time



WILLIAM R. DAY.  
ASSOCIATE JUSTICE UNITED STATES SUPREME COURT.



## DAY-LILY — DAYFLY

that elapses between two successive culminations (see *CULMINATION*) of any particular fixed star, or, in other words, is the time occupied by a revolution of the earth round its axis. The solar, astronomical, or apparent day is the time that elapses between two successive returns of the same terrestrial meridian to the centre of the sun. This period is not always of the same length, and its mean length gives us the mean solar or civil day. The 24 hours of the sidereal day are numbered in succession from 1 to 24, while the civil day in most countries is divided into two portions of 12 hours each. The abbreviations P.M. and A.M. (the first signifying *post meridiem*, Latin for afternoon; the latter *ante meridiem*, forenoon) are requisite, in consequence of our division of the day into two periods of 12 hours each. In this respect the mode of numbering the hours from 1 to 24 consecutively has an advantage, and in some countries is being introduced; in parts of Italy it has long prevailed. The Babylonians began the day at sunrise; the Jews and Greeks at sunset; the Egyptians and Romans at midnight, as do most modern peoples. Astronomers use a day of the same length as the civil, but commonly make it begin at noon and number the hours up to 24, though latterly midnight has been partly adopted as the starting-point.

If we take a day according to the second definition given above (that is, a sidereal day), its length, of course, is the same throughout the year (see *SIDEREAL TIME*). The solar day, in consequence of the varying rapidity of the earth in its orbit, and the obliquity of the ecliptic, is different at different times (see *SOLAR TIME*), and this difference is uniform throughout the earth; but the time of the natural day (or period of light) is different at the different points of the earth, according to their distance from the equator. The daily apparent revolution of the sun takes place in circles parallel to the equator. If the equator and the ecliptic coincided, the circle bounding light and darkness would always divide, not merely the equator, but all its parallels, into two equal parts, and the days and nights would be equal in all the parallels through the year; but at the poles there would be no night. Owing to the inclination of the earth's axis to the plane of its orbit (the ecliptic), the parallel of latitude in which the sun appears to move is continually changing; and therefore the equator alone (being a great circle) always remains bisected by the circle dividing light from darkness; so that the days and nights here are always equal; while the parallels of latitude, not being great circles, are not equally divided by the circle separating light from darkness, except at the time of the equinox, when the sun is moving in the equator; and, of course, at this time only are the days and nights equal in those parallels. As you approach the poles the inequality between the days and nights becomes continually greater, till, at the poles themselves, a day of six months alternates with a night of equal duration. The most distant parallel circles which the sun describes north and south from the equator are, as is well known, only  $23\frac{1}{2}^\circ$  from it. The distance between the polar circles and the poles is the same. Therefore, as a little reflection will show, when the sun is in one of the tropics, all the polar circle in the same hemisphere will be within the illuminated region (because it will be within  $90^\circ$  of the sun)

during the whole of a diurnal revolution, while the other polar circle will be in the region of darkness. These circles, therefore, have one day of 24 hours, and one night of the same length in each year. From the polar circles to the poles the time of the longest day increases fast, and in the same measure the length of the longest night. Notwithstanding the inequality of the periods of light and darkness in the different parts of the earth, each portion of the earth's surface has the sun above its horizon every year precisely six months, and below it the same length of time.

A day, in law, includes the whole 24 hours from midnight to midnight. In reckoning periods of time from a certain event, the day on which the event occurred is excluded. On the other hand, if it be required to prove survival for a certain number of days, it will suffice if the person be alive for any portion, however small, of the last day. While an obligation to pay on a certain day would therefore be theoretically discharged by payment before midnight, the law requires that reasonable hours be observed—for example, if the payment (as a bill) is at a bank or place of business, it must be within business hours.

A lawful day is a day on which there is no legal impediment to the execution of a writ—that is, a day may be unlawful, *dies non juridicus*, either by common law, or specific statute. By common law Sunday is a day on which the service of a writ cannot legally be made. Other days have been made holidays by both State and Federal statute in this country, and no such legal holiday is a lawful day.

**Day-lily**, the popular name for a genus of lilies (*Hemerocallis*), natives of temperate Asia and chiefly of eastern Europe, grown in gardens. They have long radical leaves, and a branched few-flowered scape, with handsome large blossoms, the segments of which are united into a tube. The flowers are found in meadows and along streams throughout the Atlantic seacoast from New Brunswick to Virginia, and west to Ontario and Tennessee. A species with bright yellow flowers (*H. flava*) is sometimes found near old gardens. The name of the genus is from Greek signifying "beautiful for a day." In Europe these plants are sometimes cultivated as fodder for cattle.

**Day-Blindness**, or **Hemeralopia**. See **VISION**, DEFECTS OF.

**Day of Sections**, in French history, 4 Oct. 1795, when the National Guard attacked the Convention in the Tuileries. The forces of the government, under command of Napoleon, disarmed the regiments in the different sections.

**Da'yal**. See **DRYAL-BIRD**.

**Dayfly**, a name sometimes used for the well-known Mayfly. A neuropterous insect of the family of *Ephemera*. The infant stages of larva and pupa are unusually long, often extending to 10 months; but the adult period is short, and is passed without taking food, and covers only a few hours, never more than a day. In the early summer Mayflies abound in great numbers about northern lakes and rivers, furnishing food for other insects, and for crustaceans and fish.



## DEACONESSES — DEAD

**Days of Grace.** The time at which a bill is actually due and payable, except in the case of bills payable on demand or at sight, is three days after the time expressed on the face of it, and these three additional days are called days of grace. In England if the third day of grace falls on a Sunday, Christmas Day, Good Friday, or a national fast or thanksgiving day, the bill is payable the day before. In the United States, a bill or note becoming due on a Sunday or a holiday is payable on the first business day thereafter.

**Dayton, Elias,** American soldier: b. Elizabethtown, N. J., July 1737; d. there 17 July 1807. He joined the British forces in 1760 which were employed in completing the conquest of Canada from the French; and he subsequently commanded a company of militia, with which he marched on an expedition against the northern Indians. He took part in the important battles of Springfield, Monmouth, Brandywine, Germantown, and Yorktown. After the war he served several terms in the legislature of his native State.

**Dayton, John,** American colonial governor: b. about 1761; d. Charleston, S. C., 27 Nov. 1822. He held several government offices, was chosen governor of South Carolina in 1800 and again in 1808, and was afterward appointed judge of the United States district court, a position which he held until his death. He published: 'A View of South Carolina,' and 'Memoirs of the Revolution' in that State.

**Dayton, Jonathan, LL.D.,** American statesman: b. Elizabethtown, N. J., 16 Oct. 1760; d. there 9 Oct. 1824. In 1778 he entered the American army as a paymaster. In 1791 he was elected by the Federal party a representative in Congress, in which capacity he served for three successive terms, during the last two of which he was speaker of the House. In 1799 he was elected to the United States Senate.

**Dayton, William Lewis,** American jurist and statesman: b. Baskingridge, N. J., 17 Feb. 1807; d. Paris 1 Dec. 1864. He was graduated at the college of New Jersey in 1825; and was admitted to the bar of his native State in 1830. In 1838 he was chosen one of the associate justices of the supreme court of New Jersey, which position he resigned in November 1841; and in 1842 was appointed by the governor to fill a vacancy in the United States Senate. At the expiration of his term he resumed the practice of his profession at Trenton; and in 1856 was nominated by the Republican national convention as their candidate for the vice-presidency of the United States, with Fremont as the candidate for President. He was attorney-general of New Jersey 1857-61, and was minister to France 1861-4.

**Dayton, Ky.,** city in Campbell County, on the Ohio River, and the Chesapeake & Ohio Railroad. Some of the manufactures are watch cases, pianos, whiskey; and the public buildings are good churches and schools and the Speers Memorial Hospital. Pop. (1901) 6,203.

**Dayton, Ohio,** city and county seat of Montgomery county, at the confluence of the Great Miami and Mad Rivers and Stillwater and Wolf creeks. It is on the Erie; the Dayton and Union and the Pittsburg, Cincinnati, Chi-

cago and Saint Louis Railroads; 67 miles southwest of Columbia and 60 miles north of Cincinnati. There are 125 trains entering the city daily. The Union Station was opened to the public in July, 1900, and cost including tracks \$900,000. The city has an area of 103½ square miles.

**Government.**—The Mayor, Treasurer, Auditor, Solicitor, Board of Public Service, of three members, are elected by popular election. The Board of Public Safety, of two members, and the Board of Health are appointed by the Mayor and confirmed by Council. The City Council, composed of 13 members from 10 wards, is elected by popular vote, for two years, each member receiving an annual salary of \$250. It is a legislative body only. The supply of water for the city is almost inexhaustible in quantity and of almost absolute purity. In 1904 there were 133 miles of street mains, 1,300 fire hydrants, 15,503 service taps. The Fire Department has a force of 90 men, 14 engine-houses, 50 horses maintained at a cost of \$86,728.48 and with property worth \$375,000. A complete system of surface and under-ground sewerage, both storm and sanitary, is provided. In 1904 there were 67.9 miles of storm sewerage.

**Municipal Finances.**—On 31 Dec. 1903 the city's financial statement was as follows: Assessed value of taxable property, \$47,250,640; real value of taxable property (estimated), \$100,000,000; total bonded debt, including this issue, \$2,925,000; cash value of sinking funds, \$157,000; bonded debt of city (net), \$2,768,000; water works bonds included in total debt, \$908,000; tax rate per \$1,000 valuation, 28.60.

**Banks and Banking.**—There are seven National Banks and two Savings and Trust Companies. A report of the condition of the National Banks in 1904 showed that the aggregate capital stock was \$2,400,000; surplus, \$625,000; undivided profit, \$561,412.51; with a total of loans and discounts of \$7,708,178.75; deposits, \$7,580,288.51 and a circulation of \$563,700. One of the savings and trust companies has a capital and surplus of \$250,000 and the other a capital of \$275,000. The Clearing-House reports for 1903 were \$86,807,930.41; for 1902, \$76,491,771.15. The Internal Revenue receipts for 1903 were \$2,617,679.07. Dayton takes rank as foremost in building associations of any city of its size in the country. The large number of the 20,000 or more homes in the city have been built with the aid of these associations. There are 12 associations with an aggregate authorized capital of \$49,400,000 and capital assets \$13,013,841.11.

**Manufacturing Interests.**—While Dayton's manufacturing industries are widely diversified and include the manufacture of cash registers, railroad cars, water-wheels, agricultural implements, sewing machines, foundry work, etc., these are conducted on so large a scale that many establishments employ from 500 to 2,500 hands. According to the U. S. census of 1900, the average number of wage-earners in the city was 16,869; the total wages paid was \$7,959,792 and the value of the productions was \$35,697,695. Great progress was made since 1900 and careful estimates show that in 1903 the average of wage-earners had increased to 20,740 with a total wages paid of \$10,180,619 and the value of the products \$46,595,875.

## DAYTON — DEACON

*Street Railways.*—A potent force in the development of the city has been the electric traction lines, of which Dayton has more than any other city in Ohio. There are nine lines, with a total mileage of 385 miles, which radiate in all directions through the populous and rich country of which Dayton forms the center. The city railway lines, three in number, have a total mileage of 70 miles and render excellent service.

*Education.*—The Dayton public school system has for many years enjoyed the reputation of being one of the best in the West. On 31 Aug. 1903 there were 48 schools, 23 district schools and one High School with 37 teachers and 1,058 pupils and with property valued at \$326,252. There is one Normal School with an attendance of 67, 22 Kindergartens with an attendance of 1,058, one Manual Training School with an attendance of 1,710, and one school for the deaf. The total value of school property and equipments was \$1,467,387. There are 10 Catholic Parochial Schools with 94 teachers and 3,023 pupils and two Lutheran Parochial Schools with 89 pupils and also three large colleges and seminaries for Catholic youth and four well-attended Business Colleges, one of which, the Miami Commercial College, was established in 1860. The Union Biblical Seminary is the training college of the United Brethren denomination of the United States and a very successful Arts and Crafts Society is doing excellent work. There are 90 churches in the city. Valuable adjuncts to the churches are the Young Men's Christian Association and the Young Woman's Christian Association and the Woman's League and a number of lesser church associations.

*Public Library.*—Dayton had the first library incorporated in the State, one having been established in 1805. The Public Library was opened in 1855 and is supported by public taxation, having an income of \$18,000 per annum. The total number of volumes recorded 1 Jan. 1904 was 63,133. There are five daily newspapers, each with weekly editions, besides 17 church and other publications. There are also three large church publication houses.

*Hospitals.*—The city hospitals include the Saint Elizabeth Hospital, the Miami Valley Hospital, and the Protestant Hospital which has a large central building known as the Frank Patterson Memorial of Operative Surgery, one of the most complete buildings for its purpose in the United States. The Dayton State Hospital for the insane is maintained by the State. The Hospital of the National Military Home which adjoins the city is the largest military hospital in the world and has an average of 600 patients, all of whom are Veteran Volunteer Soldiers of the Civil and Cuban War.

*History.*—The town was laid out in November 1795 by Gen. Israel Ludlow and was named after Gen. Jonathan Dayton. The first settlers arrived in the spring of 1796. Situated in the Miami Valley, one of the most fertile valleys in the United States, producing for many years great crops of corn, wheat, tobacco and numerous cattle, sheep and horses and with abundant water power to develop its industries, Dayton has grown to be the third largest manufacturing city in the State. With its industries so diversified, its banks and building associa-

tions so strong and uniformly successful and with its people so well educated, it is one of the richest and most prosperous communities in the Union.

*Population.*—(1880) 38,678; (1890) 61,229; (1900) 85,333; (1904), estimated 100,000.

A. D. WILT,  
*President Miami Commercial College.*

**Dayton, Tenn.,** city and county-seat of Rhea County; on the Cincinnati, New Orleans & Texas Pacific Railroad; about 75 miles southwest of Knoxville. It is in the centre of a coal-mining district; and iron, machinery, lumber, bricks, and flour are the chief manufactures. Pop. 2,120.

**Dayton, Wash.,** city and county-seat of Columbia County; on the Touchet River, and the Washington & Columbia River, and the Oregon railroads. It is about 28 miles, in direct line, northeast of Walla Walla and 50 miles southwest of Colfax. It is situated in one of the best agricultural regions of the State, and its trade is largely in agricultural products and cattle. It contains stores, large flouring-mills, and well-built churches and schools. Pop. 2,300.

**Daza, dā'zā, Hilarion,** Bolivian general and ex-president: b. Sucre 1840; d. 28 Feb. 1894. In 1857 he enlisted as a soldier in the famous battalion of Col. Balsa, and was rapidly promoted. On 24 Nov. 1870, by an act of treachery he deprived President Melgarejo of office, and defeated him in an engagement 15 Jan. 1871. After that he was practically the arbiter of the destinies of the country for several years. By the *coup d'état* of 4 May 1876 he became president in place of Frias. The army deposed him 27 Dec. 1879. He went to France, but after a few years returned to Bolivia, and in that country was assassinated.

**D'Azeglio.** See AZEGLIO, MASSIMO TAPARELLI, MARQUIS D'.

**Deacon** (from the Greek *diakonos*, a servant), a person who belongs to an inferior order of ministers in the Christian Church. Seven were apparently first instituted by the apostles (Acts, chap. vi.), which number was retained a long time in several churches.

In the Roman Catholic Church, a sacred minister whose functions are to assist the priest in the liturgical service and in the administration of the sacraments; also in emergencies to baptize, to preach, and to administer the Eucharist. These three functions it is not lawful for the deacon to discharge without express authority from the bishop save in case of necessity. But in the first ages of the Church it was the deacon that gave the communion, in both species, to the faithful in the public liturgical service and at their homes in case of sickness. In the present usage of the Church the diaconate is, save in exceptional cases, simply a step toward the priestly state and office and for the deacon as such there is no recognized place in the economy of the Church.

In the English Church, also, the diaconate is merely a step toward the priesthood, and the deacon's duties are all in the way of assisting the priest. He preaches only by episcopal permission, and he cannot consecrate the elements

## DEACONESSES — DEAD

of the Lord's Supper, or pronounce the absolution. No person can be ordained deacon before he is 23 years old, except by dispensation from the archbishop of Canterbury. The office of deacon in other churches varies considerably, and some, of course, have no functionaries bearing this name.

In the Methodist Episcopal churches, the junior order of the priesthood, the novitiate being first ordained a deacon, and then after a time, if satisfactory conditions have been fulfilled—such as progress in grace and gifts, and the probation of character—elevated to the full priesthood or eldership—the latter the highest order in the Church—the bishops occupying not a superior ecclesiastical order, but holding a merely supervisory office.

In the Presbyterian churches, the orders here are teaching elders, or ministers, ruling elders, generally called simply elders (these two orders looking over the spiritual affairs of the congregation); and deacons (now gradually being displaced in many places by managers), to attend to the more secular matters.

In the Congregational, Baptist, and other churches, deacons are spiritual officers ranking immediately after the minister, and looking after both the spiritual and the temporal concerns of the congregations.

**Deaconesses**, in the time of the apostles, were usually widows who assisted in the solemn baptism of women (by immersion), instructed female catechumens in the doctrines and usages of the Church, visited those of their sex who were sick or were in prison for the faith's sake, dispensed the alms of the faithful, and kept order in the women's part of the assembly room during the liturgical service. That the deaconesses were in the earliest times widows, and not maids or married women, appears from the curious fact that Saint Ignatius, disciple of St. John the evangelist, speaks of "virgins who are called widows"; as clear a proof of the original custom of choosing widows only to be deaconesses, as would be the formal declaration that such custom existed. For a long time it was required that the deaconesses should be not less than 60 years old; by the councils of Chalcedon and in Trullo the age of 45 years was made the minimum; by the Council of Chalcedon deaconesses were forbidden to marry; and no widow who had married a second time was ever admitted to the rank of deaconess. The institution of deaconesses was extinct in the western Church in the 10th century and in the Greek Church in the 12th; but it survives in churches of the Syrian rites.

The work done by the deaconesses in the early centuries is performed now, in the Roman Catholic, and in many of the Protestant Episcopal, churches by the nuns (see SISTERS). In the 19th century the order of deaconesses was revived in several of the Protestant churches. Theodore Fliedner (1836) of the United Evangelical Church of Prussia, founded a home for deaconesses, in Kaiserswörth, Prussia. Germany has several homes, and in 1855 the order was established in Baltimore, Md.

**Dead**, in nautical language, a word frequently employed as part of a designation or phrase having, in general, a meaning somewhat

opposite to that of active, effective, or real. The chief of such phrases are the following: Deadeyes: circular, flattened wooden blocks, without sheaves, and having eyes for lanyards, which form a purchase or tackle whereby the shrouds or other parts of fixed rigging are extended or set-up taut; dead-flat: the name for one of the midship-timbers; dead-lights: strong wooden shutters used to close cabin windows, on the approach of a storm, to protect the glass; dead-ropes: such as do not run in blocks; dead-wood: the term applied to the solid blocks of timber erected upon the keel throughout the sharp portions of a ship's hull at stem and stern, the chief object being to give solidity and strength to the ends of the ship.

**Dead, Book of the**, a name given to the great funerary work of the ancient Egyptians, who themselves entitled it 'Per-em-Hru,' "to go north from (or by) day." It is a collection of prayers and exorcisms composed at various periods for the benefit of the pilgrim-soul in his journey through Amenti (the Egyptian Hades); and it was in order to provide him with a safe conduct through the perils of that terrible valley that copies of the work, or portions of it, were buried with the mummy in his tomb. Such copies, hieroglyphic or hieratic, according to the age when they were executed, and made some to order, others for sale, constitute fully one half of the thousands of extant papyri. They are mostly corrupt and faulty in language. See BOOK OF THE DEAD.

**Dead, Disposal of the**. In every age and in all countries, the living have shown their respect for the dead by various modes of burial ceremony, and the religion and laws of all countries reflect in large measure this feeling of reverence for the memory of those who have gone before. The methods of disposal of the dead are many, and historic romance has preserved for us many interesting and pretty customs. In the main, however, three methods are largely employed by modern peoples—burial, embalming or its modifications, or cremation with its modifications. It is impossible to tell which method has the greatest antiquity, but probably simple burial antedated the others, since cremation and embalming usually imply a complex religious development. The Hebrews, the Greeks, and the Romans in the main, buried their dead, their burying-grounds having been located outside of town-walls; but cremation also was largely practised by the Greeks, and it has been thought that the Hebrews at one time likewise burned their dead. As is well known, embalming was widely customary among most of the nations of antiquity, although the Egyptians may be said to have been the foremost of those employing it.

The argument in favor of cremation is based principally on sanitary grounds, and despite the general sentiment against it, cremation has made considerable progress in the United States and other countries. There are crematories in many of the leading cities of America, and while much of the feeling against cremation has undoubtedly passed away, there is still great general dislike to burning of the dead.

Apart from methods of antiquity, the problem of disposing of the dead with least danger to the living is, from the medical point of view,

## DEAD-LETTER OFFICE—DEAD SEA

one of great interest. Its discussion is by no means of recent origin, however, for the early Italians, French, and English contributed learned treatises on the subject. It would seem that from the scientific point of view most of the modern writers and those of the Middle Ages strongly favor cremation as one of the cleanest and most efficient modes of disposal of the dead, and it is a matter of history how the ancient Etruscans and others had their burial urns in which to keep the ashes of their forebears.

The now universal method of burial beneath the ground is condemned by practically all sanitarians, but it will probably be many generations before the custom is abandoned, if indeed it is ever to be given up.

As to actual dangers that may arise from dead bodies buried beneath the ground, it cannot be claimed that these are imminent. Disease is mainly transmitted from the living person, and now that we have more definite knowledge of factors involved in the transmission of disease, the boggy of danger arising from burial has little terror for us. It can hardly be claimed with much show of justification that such a water-born disease as typhoid can originate from the water that may percolate through the ground in cemeteries and ultimately reach a potable supply. This danger is theoretical rather than practical, and the amount of time spent in devising methods to prevent such contamination would be much more rationally employed in taking care of the excreta of the living. The contamination of the earth, the air, and the water is, therefore, really of secondary importance; yet it cannot be denied that, excepting some exclusive cemeteries the present methods of burial are disgusting; and in times of war or pestilence not only is burial disagreeable, but there is no doubt that contagion may arise from it, and hence special portable crematories have an undeniable place. See CREMATION.

**Dead-letter Office.** See POST AND POSTAGE.

**Dead-lights.** See DEAD.

**Dead-men's-fingers**, an English fishermen's name for the *Alcyonium*, a genus of polyps, the typical one of the family *Alcyonidae*, characterized by the polyps of the colony having eight hollow arms and eight mesenteries, and a skeleton composed of separate calcareous spicules. It contains many well-known species, such as *A. digitatum*, or sea-finger (dead-men's-fingers, known also to fishermen as dead-men's-toes, and cow's-paps), and *A. glomeratum*. A common species on the United States Atlantic coast is *A. carneum*. The name is also applied to certain species of branching sponges.

**Dead-nettle**, a common name applied to the genus *Lamium* of the natural order *Labiata*, mint family. It is an annual or perennial herb, of which there are about 40 species, all natives of the Old World. It has been naturalized in America, and several species are found in waste places and cultivated ground from New Brunswick to Florida and west to Ontario, Minnesota, and Arkansas. The best-known species are *L. purpureum* and *L. album*, which are used in the northern parts of Europe as pot-herbs. A species of the genus *Galeopsis* (*G. tetrahit*) is called dead-nettle, as is one of the species of *Stachys* (*S. palustris*). It was an old belief that the hairs of the dead-nettle, when dry, caused irritation to the exposed parts of persons com-

ing in contact with the plant, and that this, extending through the system, sometimes caused death; hence the name.

**Dead Reckoning.** See DEAD.

**Dead Sea**, the usual name given to a most remarkable lake in the southeast of Palestine, called in the Old Testament "The Salt Sea," "Sea of the Plain," or "East Sea"; by Josephus, "Lacus Asphaltites"; and by the Arabs now, *Bahr-Lût*, "Sea of Lot." It is 46 miles long, with a breadth of from 5 to 9 miles. Its surface, which is lower than that of any water known, is 1,292 feet below the level of the Mediterranean. The depth of the greater part of the northern section is about 1,300 feet; but at the south end the water is only from 3 to 12 feet deep. The shape is that of an elongated oval, interrupted by a promontory which projects into it from the southeast. The Dead Sea is fed by the Jordan from the north and by many other streams, but has no apparent outlet, its superfluous water being supposed to be entirely carried off by evaporation. Along the eastern and western borders of the Dead Sea there are lines of bold, and in some cases perpendicular, cliffs rising in general to an elevation of 1,500 feet on the west and 2,500 feet on the east. These cliffs are chiefly composed of limestone, and are destitute of vegetation except in the ravines traversed by fresh water streamlets. The northern shores of the lake form an extensive and desolate muddy flat, marked by the blackened trunks and branches of trees, strewn about and encrusted with salt. The southern shore is low, level, and marshy, desolate, and dreary. On this shore is the remarkable ridge of rock-salt, 7 miles long and 300 feet high, called *Khashm Usdom* (Ridge of Sodom). Lava-beds, pumice-stone, warm springs, sulphur, and volcanic slag suggest the presence here of volcanic agencies at some period; but some modern geologists declare that no active volcanoes have ever existed in this vicinity; and that the subsidence of the Jordan Valley occurred in the Tertiary Period. On the other hand it is claimed by modern travelers that the neighborhood of the Dead Sea is frequently visited by earthquakes, and the lake still occasionally casts up to its surface large masses of asphalt. The long-entertained belief that the exhalations from this lake were fatal is not founded upon fact. Within the thickets of tamarisk and oleander which here and there may be seen upon its brink, the birds sing sweetly, and they fly over and swim about on its surface; but the salinity of the waters is adverse to life, though some lower organizations are found in them.

The water of the Dead Sea is characterized by the presence of a large quantity of magnesian and soda salts. Its specific gravity ranges from 1172 to 1227 (pure water being 1000). The proportion of saline matter is so great that, while sea-water contains only 3.5 per cent of salts, the water of the Dead Sea contains upward of 26 per cent, or more than eight times as much as that of the ocean. In all lakes or collections of water without any outflow, the water acquires an infusion of salt, its feeders constantly bringing in this material, while none can go off by evaporation, even when the shores do not as here abound in salt and nitre. The evaporation is great as the heat is intense, and the sea rather contracts than increases. Rain hardly ever falls;

the water is nearly as blue and clear as that of the Mediterranean; and though its taste is horribly salt and fetid, a bath in it is refreshing. Owing to the great specific gravity of the water, it is almost impossible for the bather to sink in it, strive as he may. Several of those who have navigated and explored the sea have fallen victims to a fatal fever. For the story of the 'Cities of the Plain,' see Gen. xix.; but according to Capt. Conder, "it is now generally agreed that the Dead Sea and Jordan were formed by a great fault or crack in the earth's surface long before the creation of man, and that the district presents in our own days much the same aspect as in the days of Abraham. It is vain, therefore, to suppose that the 'Cities of the Plain' were beneath the present sea, though this view was held as early as the time of Josephus." Steamboats are now in use on this lake.

**Deadeye.** See DEAD.

**Deadly Nightshade.** See BELLADONNA.

**Deadwood,** S. D., city, county-seat of Lawrence County; on the Fremont, Elkhorn & Missouri Valley, and the Burlington & Missouri River railroads. It is one of the principal trade centres for the mining camps of the Black Hills. A considerable amount of the gold, silver, lead, and other valuable minerals found in the Black Hills is brought to Deadwood for smelting, refining, or reshipment. Besides the large smelter and the cyanide reduction works, there are manufacturing for mining implements and machinery, brick, and planing-mills. The Masonic Temple is a large building. The first permanent settlement was made in 1876. Pop. 3,524.

**Deaf-mutes,** persons both deaf and dumb, the dumbness resulting from the deafness which has either existed from birth or from a very early period of life. Such persons are unable to speak because they have not the guidance of the sense of hearing to enable them to imitate sounds. Most deaf and dumb persons can hear some sounds, and some can distinguish a difference of pitch who perceive no difference in articulations.

The Eustachian tube extends from the tympanum into the throat; and sometimes sounds are better distinguished by opening the mouth when the external opening only is obstructed, hence the habit of "listening with the mouth open." Deafness occurs in every degree, from that which merely impairs the accuracy of the ear in distinguishing faint or similar sounds to that state in which there is no more sensation in this organ than in any other; and sound is felt in almost every part of the body as a mere vibration. Among the causes assigned for congenital deafness are consanguineous marriages, hereditary transmission, scrofula, certain local or climatic conditions, ill-health of the mother during pregnancy, etc. Though mere consanguinity can hardly be regarded as of itself a cause of this defect, yet it is an established fact that a great proportion of the deaf and dumb are the offspring of consanguineous marriages, especially of marriages between first cousins. Deafness is frequently a family trait, though it has been shown that the defect comparatively seldom descends directly from parent to child, though present in various collateral members of the family. For the causes of acquired or accidental deafness, see DEAFNESS. Where partial or complete dumbness occurs and the sense of

hearing is perfect, it will often be found to have its origin either in extreme nervous debility or in some mental derangement, and not in defective organs of speech, which in those deaf from birth are almost without exception in their normal condition. In the greater proportion of deaf-mutes no defect is visible, or can be detected by anatomical examination. The necessity of communication, and the want of words, oblige the deaf-mute to observe and imitate the actions and expressions which accompany various states of mind and of feeling, to indicate objects by their appearance and use, and persons by some peculiar mark, and to describe their actions by direct imitation. In this way there is formed a natural sign language. This language, when employed by an insulated deaf-mute, will usually exhibit only the objects of the first necessity and the most common impulses, like the language of a savage tribe. When his ideas expand from age or observation he will find new modes of expressing them; and when his education is begun an intelligent deaf-mute will often express ideas in this language for which it is difficult to find expression in words. When a number of deaf-mutes are brought together in a single institution, selections and combinations of their various dialects are formed; the best are gradually adopted by all; and a new and more complete form of the language is the result. This process, systematically carried on for years in deaf and dumb institutions at Paris and elsewhere, under the observation and direction of intelligent supervisors, has produced a language capable of expressing all the ideas we convey by articulate sounds with clearness, though not always with equal brevity. This language appears to have remarkably close resemblance to that used by the Indians of North America. (See SIGN LANGUAGE.) The Teutonic race being less disposed to the use of gestures and less ready than certain other peoples of Europe in the acquisition of the sign language, has not been so prompt to adopt it as an auxiliary in the education of deaf-mutes.

In ancient times and even through the Middle Ages it was the generally received opinion that deaf-mutes were not capable of being educated, nevertheless a few exceptional cases have been noted. Aristotle, Pliny, and Lucretius refer to this class of defective persons, and they were held by the code of Justinian as legally incapable of entering into a contract. In ancient Rome two dumb painters attracted considerable attention. About 700 A.D., according to the Venerable Bede, Bishop John of Hagunstaldt (Hexham), taught a deaf-mute to speak. The humanist Agricola (q.v.) speaks of meeting a deaf and dumb man who had learned to write. In the middle of the 16th century, Pasch, a clergyman of Brandenburg, instructed his daughter, a deaf-mute, by means of pictures. The first effort of which we have a distinct account, was made by Pedro de Ponce, a Spanish Benedictine, who instructed three deaf-mutes, of noble families, to write and speak, in 1570. His system appears to have been adopted by a countryman of his, a monk, Juan Pablo Bonet, who, in 1620, published a treatise on the art of instructing the deaf and dumb, accompanied by a manual alphabet. In 1648 John Bulwer, physician, published the earliest work in English on the instruction of the deaf and dumb, entitled 'Philocophus, or The Deafe and Dumbe Man's Friend'; in 1644 he had already



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published 'Chirologia, or the Natural Language of the Hand.' This was followed by Dr. W. D. Holder's 'Elements of Speech, an Essay of Inquiry into the Natural Production of Letters; with an Appendix Concerning Persons that are Deaf and Dumb' (1669). George Dalgarno, who was a native of Scotland, published in 1680, 'Didascalocophus,' or 'The Deaf and Dumb Man's Tutor.' To Dr. John Wallis (q.v.) is generally ascribed the merit of having been the first Englishman who succeeded in teaching deaf-mutes. The results of his labors on his first pupil were exhibited before the Royal Society in 1663; and in 1670 an essay of his on this subject was published. Contemporary with these philanthropists in England were Baron F. von Helmont and Dr. John Conrad Amman, in Holland, the latter of whom published in 1690 his celebrated work, 'Surdus Loquens.' Toward the middle of the 18th century various teachers arose in different parts of Europe. In 1743 the practicability of instructing deaf-mutes was first publicly demonstrated in France by Pereira, a Spaniard, before the Academy of Sciences, which gave its testimony to the success of the method. About the same time the Abbé De l'Epée, who devoted his life and fortune to this subject, introduced a system for the instruction of the deaf and dumb, which was taught with great success in the Royal Parisian Institution, and afterward still further developed by his pupil and successor, the Abbé Sicard. In 1778 the first public institution for the education of deaf-mutes was established at Leipsic, through the labors of Samuel Heinicke, the great upholder of the vocal, oral, or articulatory system. His followers admitted the use of the sign language in the early stages of instruction, but sought to banish it as early as possible, considering it as a rude language, incapable of improvement, and which retarded the expansion of the pupil's mind, and rendered it less necessary for him to attend to written language. They believed that no freedom in thought or in expression could be produced without articulation. Although the results of instruction by the French method seemed to disprove these views, yet the pupils of the Abbé de l'Epée and Abbé Sicard have been charged with being very mechanical in their use of signs, and having little power of original thought or sentence construction.

In 1760 Thomas Braidwood established near Edinburgh a deaf and dumb school on the articulating system, which was visited by Dr. Johnson during his tour in Scotland. It was removed in 1783 to Hackney, near London. A day-school for the instruction of deaf-mutes was established by Don Pascal de Pietro at Rome in 1784. The first public institution in Great Britain for the gratuitous education of the deaf and dumb was founded at Bermondsey in 1792 by Townsend and Mason. From this establishment originated the London Asylum in Kent Road, which was opened in 1807. In 1810 a school for affording instruction gratuitously to the dumb was founded in Edinburgh, and others of a similar description were subsequently established at Birmingham, Glasgow, Manchester, and other towns. The method employed most widely in Great Britain was for a considerable time nearly the same as that employed by Sicard in France, but the German oral system was afterward largely adopted, and in 1869

the method of Alexander Melville Bell was introduced. At the International Congress held at Milan in 1880 the oral system received almost unanimous approval, and its use was adopted in the deaf and dumb institutions of Italy, Germany, Holland, and Austria. The commissioner appointed by the French government to investigate the subject pronounced in favor of the oral method, in 1881; but later a mixed or intermediate method was advised by a congress on the subject. In 1817 the first American asylum for deaf-mutes was founded in Hartford by Thomas Hopkins Gallaudet, who followed a method comprising many of the best features of the Paris school with some others of great importance peculiar to himself. His son, Dr. E. M. Gallaudet, afterward founded, in Washington, a college for deaf-mutes. The New York Institution was founded in 1818, and the Philadelphia Asylum in 1820. The word institution or school supplanted the term asylum, when the teaching of deaf-mutes became recognized as properly a part of the general work of public instruction coming under the care of the individual States.

The Bell method of teaching deaf-mutes, which is known as the system of "visible speech," is now in extensive use. There is in Boston a training college for instructing teachers in this method. It was introduced into the Clark Institution at Northampton, Mass., in 1872. The characters of the alphabet on which this system is founded are intended to reveal to the eye the position of the vocal organs in the formation of any sound which the human mouth can utter. (See VISIBLE SPEECH.) Alexander Graham Bell (q.v.), son of the originator, and well known for his own scientific inventions, was the first to employ this alphabet in the teaching of deaf-mutes in America. The career of Helen Keller has done much to direct public attention to this method.

Articulation is learned by the deaf-mute as a set of movements and sensations in the organs of speech. It is taught by pointing out to the pupil the positions of the lips, teeth, and tongue, in pronouncing the vowels and consonants; by making him feel with his hands all the perceptible movements and vibrations of the throat and other organs which are requisite for their pronunciation; and by using diagrams, etc. He is then required to imitate these positions, and to force a quantity of air from the lungs sufficient to produce the sounds, and is taught to read the articulations of others, by observing the position of the organs and the countenance. The facility of doing this will depend much upon the pliability of the organs of speech, and the nature of the language to be learned. Some advocates of articulation believe that, by that portion of the pupils of every institution whose organs are pliable and who have some remnant of hearing (those termed *demisourds* in the Paris school), the acquisition may be made with a degree of ease and perfection which renders it an important branch of instruction for them. But they are equally convinced that to attempt to teach articulation to those entirely destitute of sensibility in the ear, or who cannot exercise the organs of speech without difficulty or pain, is a useless labor, and may produce disease in the pupil.

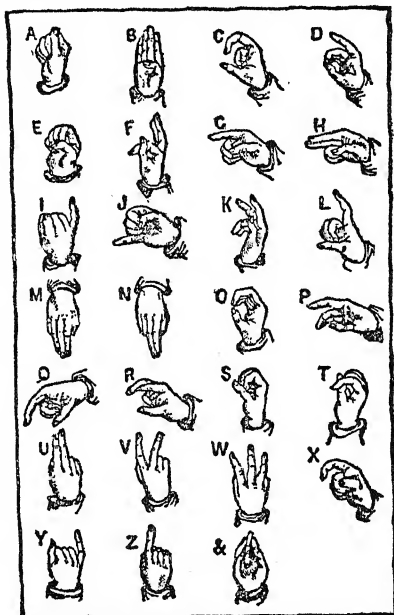
The sight of deaf-mutes is sometimes so well



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trained that they prove very proficient in lip-reading; and if, in addition, their articulation is distinct they can carry on considerable conversation with persons who know nothing of the sign language or of the manual alphabet, cases being known where persons have conversed with the deaf and dumb and remained ignorant that those to whom they were speaking were afflicted in this way.

There are two kinds of manual alphabet, the double-handed alphabet, where the letters are expressed by the disposition of the fingers of both hands; and the single-handed, in which



Deaf-mute Alphabet. Single Hand.



Deaf-mute Alphabet. Double Hand.

the letters are formed with the fingers of one hand.

Spelling by the hand is not a part of the sign language but is frequently acquired in addition to the latter and is very commonly used, being an art easily acquired.

In 1903 much interest was aroused by the testing in New York of the acousticon, an instrument devised for enabling the deaf to hear. The inventor, Mr. Hutchinson, had previously exhibited it in England, and the tests in both cases appeared to be remarkably encouraging. The acousticon is a device involving all the important principles of the telephone, with improvements for giving intensity to sound waves. It is in three pieces, which may be carried in the pocket. The one answering to a telephone transmitter is a vulcanized rubber disk about three inches in diameter. To its back is attached a hook by which it may be suspended from a waistcoat pocket. The reverse face of the disk is hollowed and in the hollow certain gases are hermetically sealed. The other two pieces are the earpiece, which corresponds to the receiver of a telephone, and the battery. The latter is about three inches long, two inches wide and half an inch thick. Wires connect the three pieces of the machine. The sound that is to be transferred is caught by the receiver and intensified before it passes to the ears of the subject.

In 1901 Germany led the European states in the number of schools for the deaf, having 98. In France there were 70 such schools, in Great Britain and Ireland 46, in Italy 35, in Austria-Hungary 19, in Norway and Sweden 17, in Switzerland 13, in Russia 13, in Spain 7. There are about 23 other institutions for deaf-mutes in various parts of Europe, and India and Japan have established a few schools. In Canada there are 7, and the United States leads the world with 103 public and 15 private institutions of this nature. Fifty-seven of the public schools are State institutions and 46 are day schools. In the State institutions there were, in 1901, a total of 10,069 pupils. Some are taught by the manual method, others by the purely oral; but the larger number of schools prefer a combined method. Manual training is an important feature in schools for deaf-mutes. There are also six periodicals in the United States devoted to the interests of deaf-mute instruction. The proportion of deaf-mutes in the United States is 1 to 2,400. There were on 1 June 1890 a total of 121,178 deaf persons, of whom 40,592 were deaf-mutes, and 80,611 were able to speak. See DEFECTIVES, EDUCATION OF.

**Bibliography.**—'American Annals of the Deaf' (Washington); Arnold (Thos.), 'The Education of the Deaf and Dumb' (London 1872); Bell (A. G.), 'Mémorial on the Formation of a Deaf Variety of the Human Race'; 'Education of the Deaf' (1898); 'Growth of the Oral Method of Instructing the Deaf' (1896); Bell (A. M.), 'English Visible Speech'; Gallaudet (E. M.), 'The Deaf and Their Possibilities' (1898); 'Values in the Education of the Deaf' (1893); Garrett, 'Directions to Parents of Deaf Children'; Gillett (P. G.), 'Some Notable Benefactors of the Deaf'; Gordon (J. C.), 'The Difference Between the Two Systems of Teaching Deaf-Mute Children' (1898); Peet, 'The Family Instruction of the Deaf'; 'Reports of American Institutions for the Deaf.'

## DEAF-MUTES — DEAL

**Deaf-mutes, Teaching Speech to.** The fact that deaf-born infants make the same babbling efforts to talk as hearing ones and also the fact that a few mothers by giving them the same repetition through their eyes, of the beginnings and progress of language, as they gave their hearing children through their ears, resulting in these deaf children acquiring articulate language and the ability to understand the spoken language of others, induced Emma and Mary S. Garrett to make the experiment of applying this same treatment to the deaf in general.

The experiment began 2 Feb. 1892, as a private effort, with 11 deaf children in a little old building in West Philadelphia, Pennsylvania. In July 1893 it became a State Institution under the title of Home for the Training in Speech of Deaf Children before they are of School Age, and between then and now two large cottages have been erected at Belmont and Monument Avenues, Philadelphia, Pa., on the confines of the Park, each capable of holding 30 children and both of which are constantly filled.

Deaf children are received between the ages of two and eight, the nearer the minimum age the better. Their training is made to conform as nearly as possible to the proper training of normal children. Their lack of hearing every word spoken in their presence, which is the way hearing children learn language, is supplied by intelligently giving them enough repetition of ordinary language through the eye to equal this. Except for this, their training is identical with that of normal children. No signs or motions are ever used to convey ideas to their brains; articulate speech alone is used. There are no vacations as there is no break in the summer in the acquirement of language by hearing children. The results are that all children who have *completed* the training are attending ordinary schools with hearing children; the only special thing required for them being a seat where they can see the teacher's face. Deaf boys, who after completing their preparatory training in the Home have been several years in public schools for hearing children, are learning their trades among hearing people among whom they must ply them. Reports from teachers and employers alike confirm the ability of these children to keep abreast of their classes in school and their fellow workmen in the shops.

These results would not be possible with deaf children deprived of any part of the opportunities which all hearing children enjoy for the development of the powers which they possess in common, nor can any better medium for this be devised than the natural one of articulate speech and language. These are also the medium of communication in the hearing world in which they must pass their lives, and a knowledge of them is indispensable to their usefulness and happiness.

There is no reason physical or mental for depriving deaf infants of learning articulate speech and language at the natural age and they evidence their aptitude to acquire them by babbling in earliest infancy just as hearing babies do.

MARY S. GARRETT,

*Principal and Founder of Home for the Training in Speech of Deaf Children before they are of School Age, Belmont and Monument Avenues, Philadelphia, Pennsylvania.*

**Deafness**, a condition in which there is loss of hearing, partial or complete, due to disturbance or destruction of some part of the hearing apparatus, either external or internal. Deafness may be acquired during life, or may be congenital. In most cases of congenital deafness, deaf-mutism results. (See DEAF-MUTES.) Of the acquired forms of deafness, those resulting from disease and destruction of some portion of the middle ear are the most common. Otitis media (q.v.), the commonest cause, may occur at all ages, and is a very frequent accompaniment of some of the acute infectious diseases, particularly measles, scarlet fever, and influenza. In these there is an inflammation in the nose and pharynx. The inflammation ascends the Eustachian tube and, being accompanied by some of the ordinary pus micro-organisms, notably the *Staphylococcus pyogenes aureus*, causes the formation of an abscess in the middle ear. This gives rise to severe earache, and finally to rupture of the drum and discharge of the pus. In many such cases recovery is complete, but in others there is partial destruction of the small bones of the conducting apparatus or even more important structures, resulting in partial or complete deafness. In the aged, chronic inflammation of the middle ear from nasopharyngeal catarrh is perhaps the most common cause of deafness. The middle ear contributes nearly three fourths of all cases of deafness, the external ear a little less than a quarter and the internal ear a very minute remainder.

**Deak, dā-āk', Ferencz**, Hungarian statesman: b. Söjtör, Zala, Hungary, 17 Oct. 1803; d. Budapest 29 Jan. 1876. Having studied law at Raab, he practised for some time as a barrister, but his political career began with his election to the National Diet in 1832. He soon became, in spite of his loyalist and conservative tendencies, a prominent member of the liberal opposition. At the revolution of 1848 he became minister of justice, but retired when Kossuth obtained power. On the defeat of the patriots in 1849 he retired from public office and did not return till the Franco-Austrian war gave him an opportunity of serving his country. He is regarded as the master-spirit of the movement by which the ancient independence of his country was restored in 1867. Though the leader of the liberal party, he constantly refused office, but no change in the ministry was made without his consent. See Forster, 'Francis Deák, Hungarian Statesman' (1880).

**Deakin, Alfred**, Australian cabinet officer: b. near Melbourne, Victoria, 3 Aug. 1856. He was educated at Melbourne University; was minister of public works and water supply, 1883-6; solicitor-general 1885; chief secretary 1886-90; member of federal council 1889-95-97-99; and has been attorney-general of the commonwealth of Australia from 1901. He has published 'Irrigation in Western America' (1885); 'Irrigation in Egypt and Italy' (1887); 'Irrigated India' (1892); 'Irrigation in Australia' (1893); 'Temple and Tomb' (1894).

**Deal**, in the United States, a plank 12 feet long, 11 inches wide, and 2½ inches thick. Deals are sawed of other sizes, but are reduced to that cubic dimension in computing them. The name deal is applied in Europe to boards of fir above 7 inches in width and of various lengths exceeding 6 feet. If 7 inches or less wide they are

called battens, and when under 6 feet long they are called deal-ends. The usual thickness is 3 inches, and width 9 inches. The standard size, to which other sizes may be reduced, is  $1\frac{1}{2}$  inch thick, 11 inches broad, and 12 feet long. Whole deal is deal which is  $1\frac{1}{2}$  inch thick; slit deal, half that thickness. Deals are exported from many parts of Europe and the American continent. In the timber trade 50 cubic feet of deals are a load, and 100 feet superficial are a square.

**Dealfish**, deep-sea bony fishes of the family *Trachypteridae*, allied to the oar-fish and the ribbon-fish (q.v.). As the name suggests, the elongated body is laterally compressed, and with the exception of a small separate elevated anterior portion, the dorsal fin is continuous along the back. The anal fin is absent. The tail-fin is peculiar in being sharply turned upward. The skeleton is very fragile. Some eight species are known from specimens accidentally thrown ashore on European coasts and from the west of South America.

**De Amicis, Edmondo.** See **AMICIS, EDMONDO DE.**

**Dean, Amos**, American jurist: b. Barnard, Vt., 16 Jan. 1803; d. Albany, N. Y., 26 Jan. 1868. He early acquired eminence in his profession and after being professor of medical jurisprudence in the Albany Medical School and of law in the Albany Law School, became chancellor of the University of Iowa in 1855. Among his published works are: 'Lectures on Phrenology'; 'Manual of Law' (1838); 'Medical Jurisprudence' (1854); 'Bryant and Stratton's Commercial Law' (1861).

**Dean, John Ward**, American genealogist: b. Wiscasset, Maine, 13 March 1815; d. Medford, Mass., 22 Jan. 1902. He was educated in the public schools of Portland, Maine, learned the bookbinding trade and conducted a bookbinding business in Boston for many years, till his appointment in 1872 as librarian of the New England Historic Genealogical Society. Save from 1889 to 1893 he filled this position until his death. He was editor of the 'New England Historical and Genealogical Register', and of nine volumes of the 'New England Biblioplist' 1880-98. Among his writings are numerous biographical memoirs, including the 'Memoir of Nathaniel Ward' (1868); 'Memoir of Michael Wigglesworth' (1871); and the 'Story of the Embarkation of Cromwell and his Friends for New England.'

**Dean**, in ecclesiastical language, a church dignitary presiding over the chapter of a cathedral. The word is from the French *doyen* and from the Latin *decanus*, one set over 10 (Gr. *deka*, Lat. *decem*, 10). Originally *decanus* was the designation of a petty civil functionary: its ecclesiastical use had its rise in monachism, where a *decanus* was named to be chief and monitor of 10 monks or 10 hermits; and the senior *decanus* of a *canoniam* served as head of the monastic community in the absence of the abbot. From the institution of canons regular, serving in the chapters of cathedral churches, came the usage of naming the chief among the canons of a chapter as its dean. Rural deans are parish priests who, appointed by the bishop, exercise a certain jurisdiction and supervision over the churches or congregations and their rectors within a definite district in a diocese. In the

Curia Romana, the dignity styled Cardinal Dean of the Sacred College is the chief among the cardinals and is usually the oldest of the seven cardinal bishops: he succeeds his predecessor in the see of Ostia. From ecclesiastical usage the term dean was adopted as designation of the leading member of various secular bodies, for example, the head of a university faculty, or a college, or of a guild.

In the Church of England some of the deaneries are valuable benefices. A dean may hold one other living along with his deanery. He is bound to reside eight months of the year at his cathedral. The Bishop of London holds the honorary office of dean of the chapel royal, and there is also a sub-dean and chaplains. Rural deans are beneficed clergymen appointed by the bishop or archdeacon to exercise jurisdiction in certain matters in some part of the diocese. This office had fallen into disuse, being superseded by the appointment of archdeacons, but has latterly been revived. The rural deans hold office during the life of those by whom they are appointed. There are also a few deans called deans of peculiars, who exercise an independent jurisdiction, and are not under a bishop. Deans of colleges are, in English universities, officers appointed to superintend the behavior of the members, and to enforce discipline. In the universities of Scotland and elsewhere the head of each of the faculties of law, theology, medicine, science, etc., is called dean of the faculty. The dean of guild in Scotland is a burgh official whose duty it is to see that buildings are erected in accordance with the municipal regulations. In Scotland the honorary title of dean of the chapel royal is bestowed on a clergyman of the Established Church, and six chaplains are also appointed to a similar honorary office. In universities in the United States the dean of a department is the registrar or secretary, and in some institutions he has considerable to do with the discipline.

**Deane, Charles**, American antiquarian: b. Biddeford, Me., 10 Nov. 1813; d. Cambridge, Mass., 13 Nov. 1889. He was for many years a merchant in Boston but retired from business in 1864 and devoted himself to the collection of works relating to American history. He edited 'Bradford's History of Plymouth Plantation' (1856); 'Wingfield's Discourse of Virginia' (1860), etc.

**Deane, Silas**, American diplomatist: b. Groton, Conn., 24 Dec. 1737; d. Deal, England, 23 Aug. 1789. He was graduated at Yale College in 1758, and was a member of the first Continental Congress in 1774. He was sent by Congress to France as a political and financial agent, with instructions to ascertain the temper of the French government concerning the rupture with Great Britain, and to obtain supplies of military stores. But he did not confine himself to his instructions, but made promises and engagements on all sides, which afterward brought the Congress into considerable embarrassment. When it was determined to send ministers to negotiate treaties, Dr. Franklin and Arthur Lee were commissioned to join him at Paris, and he assisted in the negotiation of the treaty with France. In consequence of the extravagant contracts he had entered into, he was recalled 21 Nov. 1777, and John Adams appointed in his place. He left Paris 1 April 1778, and upon his return, being called upon to give an account of

his proceedings on the floor of Congress, evaded a complete disclosure upon the ground that his papers were in Europe. He then attacked his fellow commissioners and Congress itself in a public manifesto for the manner in which he had been treated, but did not succeed in removing the public suspicion from himself. He afterward published in 1784 'An Address to the Free and Independent Citizens of the United States' on the same subject, and returning to Europe, died in great poverty. See 'Papers in Relation to the Case of Silas Deane' (1855).

**Deans, Jeanie**, the heroine of Sir Walter Scott's tale, 'The Heart of Midlothian.' When her sister Effie was sentenced to death for the murder of her own child, Jeanie went on foot to London and obtained from the queen a pardon for her sister. Her devotion forms a contrast to the attitude of the father, David Deans, whose rigid sense of justice leads him, in spite of the dictates of his heart, to drive Effie from his door. Effie is married to her lover and becomes a lady of the court.

**Dearborn, Henry**, American soldier: b. Hampton, N. H., March 1751; d. Roxbury, Mass., 6 June 1829. He was practising medicine at Portsmouth when, on hearing the news of the battle of Lexington, 20 April 1775, he immediately marched with 60 volunteers, and was at Cambridge early the next day, a distance of 65 miles. He was made a captain, was at the battle of Bunker Hill 17 June, and accompanied Arnold on the expedition through the woods of Maine to Quebec. He served as major under Gates at the capture of Burgoyne, and distinguished himself and his regiment by a gallant charge at the battle of Monmouth in 1778. In 1779 he served in Sullivan's expedition against the Indians, in 1780 with the army of New Jersey, in 1781 at Yorktown, and in 1782 was on garrison duty at Saratoga. He was twice member of Congress, and for eight years, during the presidency of Mr. Jefferson, secretary of war. In 1809 he was made collector of Boston, and on 27 Jan. 1812, became senior major-general in the United States army. Resigning his commission in the army in 1815, he was appointed, 7 May 1822, minister to Portugal, where he remained two years, and was recalled at his own request.

**Dearth, Henry Golden**, American painter: b. Bristol, R. I., 1863. He studied at the Ecole des Beaux Arts in Paris; and among his works are 'Evening' and 'Autumn.'

**Death**, in common language, a state opposed to life, and considered as the cessation of it. Strictly speaking, we can trace only the cessation of organic life. The matter of which the body is composed does not perish on the death of an organized being; it undergoes various changes, which are known by the names of decay and putrefaction, and which are the preparation for its becoming subservient to new forms of life. What becomes of the mind, or thinking principle, whether in man or animal, after death, is a matter of philosophical conjecture or religious faith. The investigations of science do not throw the least light upon it. The change here adverted to, which is called death, does not take place so quickly as is generally believed. It is usually preceded and caused by disease or the natural decay of old age. The state called death takes place suddenly only when the heart or the brain is injured in certain parts. Probably the brain

and the heart are the parts from which, properly speaking, death proceeds; but as the cessation of their functions is not so obvious as the cessation of the breath, which depends on them, the latter event is generally considered as indicating the moment when death takes place. In the organs of sense and motion the consequences of death first become apparent; the muscles become stiff; coldness and paleness spread over the whole body; the eye loses its brightness, the flesh its elasticity; yet it is not perfectly safe to conclude, from these circumstances, that death has taken place in any given case, because experience shows that there may be from certain causes a state of apparent death, in which all these circumstances may concur without the extinction of the vital spark. The beginning of putrefaction, in ordinary cases, affords the first certain evidence of death. Putrefaction begins in the bowels and genitals, which swell, become soft and loose, and change color; the skin also begins to change, and becomes red in various places; blisters show themselves; the blood becomes more fluid, and discharges itself from the mouth, nose, ears, eyes, and anus. By degrees, also, the other parts are decomposed, and, last of all the teeth and bones. In the beginning of decomposition nitrogen and ammonia are produced: in the progress of it, hydrogen, compounded with carbon, sulphur, and phosphorus, is the prevailing product, which causes an offensive smell, and the light which is sometimes observed about putrefying bodies. At last, only carbonic acid gas is produced, and the putrefying body then smells like earth newly dug. A fat, greasy earth remains, and a slimy soap-like substance, which mixes with the ground, and contributes with the preceding decompositions to the fertility of it. Even in these remains of organized existence organic life is not entirely extinct; and they contribute to produce new vegetable and animal structures. Putrefaction is much influenced by external circumstances, particularly air, heat, and water. When the body is protected from the action of such agents it changes into adipocere (q.v.); but this process requires a much longer time than common putrefaction. In very dry situations the body is converted into a mummy, in which state bodies are found in the arid deserts of Africa, and on the mountains in Peru. Some vaults are remarkable for preserving corpses from putrefaction. It is well known to every reader that particular substances counteract putrefaction; for instance, those used in tanning, and in embalming mummies.

The death-agony is the state which immediately precedes death, and in which life and death are considered as struggling with each other. This state differs according to the cause producing it. Sometimes it is a complete exhaustion; sometimes a violent struggle, and very irregular activity, which at last, after a short pause, terminates in death. In some cases consciousness is extinguished long before death arrives; in other cases it continues during the whole period, and terminates only with life. The person in this condition has already somewhat the appearance of a corpse: the face is pale and sallow, the eyes are sunken, the skin of the forehead is tense, the nose pointed and white, the ears are relaxed, and the temples fallen in; a clammy sweat covers the forehead and the extremities, the alvine discharges and that of the urine take place involuntarily, the respiration becomes rattling, interrupted, and at length ceases

## DEATH

entirely. At this moment death is considered to take place. This state is of very different length; sometimes continuing for minutes only, sometimes for days. When the patient is in this condition nothing should be attempted but to comfort and soothe him. As long as the dying person is able to swallow, wine or other cordials may be given from time to time.

*Signs of Death.*—During death the larger physical processes, such as respiration and circulation, may first cease, but molecular activity may persist for some time, as is evidenced in the common observation of the growth of hair after death. The desirability of knowing the absolute signs of death is due not so much to the danger of burying the living, as to the possibility that efforts at resuscitation may not be adequately performed in cases of apparent death. The idea that at the present time people can be buried alive is more or less absurd; but it is very true that many cases of apparent asphyxia, notably following drowning or electrical shock, are recoverable if proper means are taken.

There are a number of conditions that simulate death. The commonest of these are catalepsy and trance states, partial asphyxia, and syncope or fainting. In catalepsy there is usually a loss of consciousness, the muscles of the body generally become very rigid, but the limbs may be readily moved and placed in various positions. The temperature is lowered, but the respiration and the heart-action, while reduced, are apparent. In trance the appearance of death is much more striking, consciousness is usually abolished, the face is pale, the limbs may be flaccid, and sometimes are rigid, the reflexes may be lost, and the pupils may be dilated and immobile. The absence of the signs of decomposition, the normal ophthalmoscopic appearance of the fundus of the eye, and the persistence of electrical excitability are sufficient, however, for determining this condition. Partial asphyxia by drowning is one of the most frequent causes of apparent death. Resuscitation has resulted even after a body has been under water for an hour. This fact emphasizes the desirability of continued treatment in all cases of asphyxia by drowning. Ordinary fainting is readily distinguished from normal death.

The special signs of death are those that involve the circulation, respiration, conditions of the muscular system, and certain changes in the eye. Circulatory changes are those of stoppage of the heart, with consequent loss of heat and coagulation of the blood. Careful listening to the heart-sounds by means of specially devised instruments may be necessary to determine whether the heart has stopped beating or not, and special methods of applying ligatures to the lobe of the ear or the finger, cutting off the venous return and permitting the ordinary inflow to continue, may be used. The respiratory changes consist of cessation of respiration, with consequent change in the color of the patient, there being marked pallor in distinction usually to marked cyanosis of asphyxia. A mirror placed before the nose or over the mouth will sometimes detect breathing when it cannot be seen or heard; and if a vessel of water be placed over the chest, movements of that organ may be detected. Muscular changes are very characteristic. There is usually complete muscular relaxation, followed by great stiffness (*rigor mortis*) after a certain number of hours. There is com-

monly loss of excitability of the muscles. Changes in the eye are corroborative rather than unique. The iris is usually flaccid; the pupil is ordinarily moderately dilated and unresponsive to light, and is not reacted upon by atropine or eserine half an hour after death. There is a marked anaemia of the fundus of the eye when viewed with the ophthalmoscope.

Finally there are a series of cadaveric changes that result and which are indubitable evidence of death. There is gradual loss of heat, although in certain cases of cholera temperatures as low as 76° F. have been observed, and the patient has still lived. *Rigor mortis* develops, probably, by the action of a ferment resulting in the formation of myosin. This condition may come on very rapidly, sometimes in a few hours, but complete *rigor mortis* rarely takes place within this time. Occasionally there is an instantaneous *rigor mortis*, when death occurs suddenly during violent muscular exertion. This happens in times of war, when weapons are sometimes firmly grasped in the dead hand; and in some cases of drowning the patients may be found with weeds and mud clutched in the fingers. The disappearance of *rigor mortis* usually takes place in from 16 to 36 hours, although there is no absolute rule. Coagulation of the blood, post-mortem hypostases, post-mortem lividities, and putrefactive decoloration, with formation of gases, are usually characteristic and unequivocal.

*Death in Mythology, etc.*—The representation of death among nations in their earlier stages depends upon the ideas which they form of the state of man after this life, and of the disposition of their gods toward mankind. In this respect the study of these representations is very interesting. Of later ages the same cannot be said, because imitations of representations previously adopted are very often the subjects of the plastic arts in such periods. However, these representations do not altogether depend on the causes above mentioned, as the general disposition of a nation (for instance, that of the Greeks, who beautified every object) has also a great influence upon them. The Greeks represented death as a pleasing, gentle being, a beautiful youth. They personified death under the name Thanatos, while the Keres were rather the goddesses of fate and violent deaths, like the Valkyries in the northern mythology. According to Homer, Sleep and Death are twins, and Hesiod calls them the sons of Night. They are often portrayed together on cameos, etc. During the most flourishing period of the arts Death was represented on tombs as a friendly genius with an inverted torch, and holding a wreath in his hand; or as a sleeping child, winged, with an inverted torch resting on his wreath. Sleep was represented in the same manner, except that the torch and wreath were omitted. According to an idea originating in the East, death in the bloom of youth was attributed to the attachment of some particular deity, who snatched his favorite to a better world. It was ascribed, for instance, to Jupiter, or to his eagle, if the death was occasioned by lightning; to the water-nymphs if the individual was drowned, as in the case of Hylas; to Eos or Aurora if the death happened in the morning; to Selene, if at night, etc. These representations were more adapted to relieve the minds of surviving friends than the pictures of horror drawn by later poets and artists. (See Herder's 'Wie die Alten den Tod



## DEATH-ADDER—DEATH VALLEY

gebildet.') Euripides, in his 'Alcestis,' even introduced Death on the stage, in a black robe, with a steel instrument in his hand, to cut off the hair of his victims, and thus devote them to the infernal gods. The later Roman poets represent Death under more horrible forms, gnashing his teeth, and marking his victims with bloody nails, a monster overshadowing whole fields of battle. The Hebrews, likewise, had a fearful angel of death, called Samael, and prince of the world, and coinciding with the devil; but he removes with a kiss those who die in early youth. The disgusting representations of Death common among Christians originated in the 14th century; for the representation of Death as a skeleton merely covered with skin, on the monument at Cumæ, was only an exception to the figure commonly ascribed to him among the ancients. In recent times Death has again been represented as a beautiful youth—certainly a more Christian image than the skeleton with the scythe. The monument made by Canova, which George IV. erected in honor of the Stuarts in St. Peter's Church at Rome, represents Death as a beautiful youth. He is sometimes portrayed under the figure of a dying lion.

**Causes of Death**—There are 15 principal causes of death, with the rate per 100,000, as given by the census bureau. They are as follows: Pneumonia, 191.9; consumption, 191.5; heart disease, 134; diarrhoeal diseases, 85.1; kidney diseases, 88.7; apoplexy, 66.6; cancer, 60; old age, 54; bronchitis, 48.3; cholera infantum, 47.8; debility, 45.5; inflammation of brain and meninges, 41.8; diphtheria, 34.4; typhoid, 33.8; and premature birth, 33.7. Death from all principal causes shows a decrease during the last two decades, the most notable instance being that of consumption, which shows a decrease of over 50 per cent per 100,000. The world's death-rate is estimated at 68 a minute, 97,920 a day, and 35,740,800 a year.

**Death-adder** (*Acanthophis antarcticus*), a very venomous and justly feared snake of Australia, which also occurs throughout the Indo-Malayan Islands to the Moluccas. It belongs to the *Elapida*, of which the cobra is also a member, but the death-adder lacks the spreading "hood." The end of the tail is flattened laterally, and is terminated by a horny spine, anterior to which are several rows of enlarged scales which, as well as the habit of elevating and rapidly vibrating this region, does not materially differ from the characteristic rattle of the American rattlesnake.

**Death, Civil**, formerly the entire loss or forfeiture of civil rights, which followed on attainiture for treason or felony. Formerly a man was considered civilly dead who retired into a monastery or abjured the realm. By Act 33 and 34 Vict. cap. xxiii. a conviction for treason or felony no longer causes attainder or forfeiture of civil rights.

**Death, Dance of.** See DANCE OF DEATH.

**Death Duties.** See INHERITANCE TAX.

**Death-tick**, a neuropterous insect of the family *Psocida*, of the size and appearance of the common plant-louse, one species of which is a visitor of gardens. Another species is the little book-louse found running over books and feeding on the paper. In England it is called "deathwatch," because there it is said to make a

ticking sound like that of the beetle (*Anobium*), thus exciting many superstitious notions. See DEATHWATCH.

**Death Valley**, a low desert in Inyo County, Cal., near the Nevada border. The name of this region was given by a survivor of an emigrant party of 30 who, in 1849 or 1850, lost their way here, and of whom, after enduring indescribable sufferings, 18 perished in the sands. No other such spot is known. Like all the great valleys of California, it lies oblong from north to south. Its length is about 50 miles; width about 35; surface about 210 feet lower than that of the ocean. The Panamint Mountains shut out from it the moist winds of the Pacific. In the August atmosphere there is less than one half of one per cent of moisture. The surrounding country is made up of volcanic ranges—black, red, green, yellow, and brown—which have furnished the valley with the borax now found there.

On the north of the valley is Ralston Desert, on the west Panamint Desert, on the south Mojave Desert, and Amargosa Desert is on the east. Death Valley has the lowest depression. Summer heat here rises to 137° F. or more, far higher than anywhere else in the Western world. Death Valley, as seen from the summit of the Panamint Range, presents in November a long gray waste desert, in which there are narrow bands of white made by thin deposits of borax; and to the south is seen a thin line like a blade of steel—the Amargosa River, as it dies away upon entering Death Valley sink. It is a sluggish, dead stream, and evaporation and absorption at last take it all.

The land was the centre of a system of lakes when the Sierra Nevada had not yet risen. Toward their summit, the Panamint Mountains are of carboniferous limestone formation, rifted and worn, with a very slight growth of piñon, pine, mahogany, and juniper, near the crests; and below the vegetation becomes more scant. In the gorges and narrow cañons are seen numerous vines and creepers, on which grow wild gourds resembling oranges, also similar to the bitter desert apples that grow near the site of ancient Sodom. Here also are the most distorted forms of the cacti, and an inferior growth of greasewood or palaverde. The wealth of this desert is wholly mineral.

A sand-storm playing in Death Valley is a wonderful sight. Sand-augers rise like slender stems, reaching up into the burning atmosphere for thousands of feet and terminating in a bushy cloud. They travel hither and thither and gradually fade from sight. Here mirage raises up spectral cities, groves, fields, and tree-margined rivers. A low ruin will seem to be hundreds of feet high; arrow-weeds are magnified into stately palms; and crows walking on the ground appear as men on horseback. Besides crows, here are seen a few poor jack-rabbits, mangy coyotes, buzzards, horned toads, red-eyed rattlesnakes, mice and mountain rats; and in the Panamint Range there are still a few bighorns or Rocky Mountain sheep.

At the summit of the Panamint and Funeral mountains, the thermometer at times, it is said, falls to 30° below zero. The mineral wealth of this region is great. In the Panamint Range are many mines of antimonial silver ore, and copper, gold, iron, travertine, onyx, and marble are also found. In the Funeral Range, gold, silver, lead,



copper, and antimony have been found in paying quantities, while the thick strata or measures of the east and southeast hills show almost inexhaustible quantities of colesmanite, a borate of lime named for W. T. Coleman, who was one of the first to discover this deposit and find out its richness in borax. Very rich gold quartz has been taken from mines along the route traveled by the ill-fated old emigrant party.

Human society in Death Valley is confined to a few miners in the Funeral, Calico, and Panamint mountains, some few roving bands of Piute Indians, and a few squaw-men owning cattle and horses.

Visitors to Death Valley should not go earlier than 15 October, nor later than 15 April; no one should attempt to cross it while a sand-storm is blowing; a gallon of water is needed for each person in a party, and three gallons for each horse. At present one can go from Dagget on the Atlantic & Pacific Railroad, but the route is little better than from Panamint to Furnace Creek and up through Nevada via Pioche, Nev.

**Death's-head Moth**, a species (*atropos*) of *Acherontia*, genus of the Sphinx or hawk-moth family, one of the largest of the group, widely distributed over the world, being found in parts of Africa, Asia, and Europe. It is crepuscular in its flight. Its fore wings are blackish-brown, with transverse lines of black and a white spot near the middle. The hind wings are yellow, with black stripes crossing the middle and tracing the margin. Upon the dark thorax is described in pale yellow a mask resembling a man's skull. Hence the common name. The moth is about five inches in extent of wings. The caterpillar is of the same length, of bright yellow color, with violet stripes and a row of blue spots along the back. It is injurious to potato and tomato plants, and in some localities is said to rob beehives of their honey, withstanding the attacks of the bees. When frightened or seized, the moth gives forth a squeaking noise. This, with the death's-head, suggests an evil omen to the superstitious, making appropriate the generic name *Acherontia*.

**Deathwatch**, a small blackish beetle, about a quarter of an inch long, of the genus *Anobium*, common in Europe and America. It receives its ordinary name from the ticking sound which it makes in the woodwork of houses — 6 to 12 distinct ticks being produced at regular intervals, like the clicks of a watch. These rappings are caused by the striking of the beetle's head on the hard wood, presumably to attract the attention of its mate. Both the beetle and the larvæ of several species are destructive of books, and are the real bookworms.

**Debacle**, dā-bā'kl (Fr. *débâcle*), a sudden breaking up of ice in a river; used by geologists for any sudden outbreak of water, hurling before it and dispersing stones and other debris.

**Debain**, Alexandre François, ä-lëks-ändr frän swä dē-bän, French musical inventor: b. Paris 1809; d. there 3 Dec. 1877. He was a maker of musical instruments and invented the harmonium in 1840.

**De Bary**, Heinrich Anton, hīn'rīn än'tōn dā bā'rē, German botanist: b. Frankfort-on-Main 26 Jan. 1831; d. Strasburg 19 Jan. 1888. After a course of medical studies he began in 1853 to practise in his native city, but next

year became a *privat-docent* in Tübingen, and the year after was called to be professor of botany at Freiburg, where in 1850 he was appointed ordinary professor. In 1867 he obeyed a call to Halle, and in 1872 to Strasburg, where he was the first rector of the newly reorganized university. As a botanist, De Bary is famous especially for the contributions he has made to our knowledge of the morphology and physiology of the fungi and the Myxomycetæ. Of his numerous works in these departments, the 'Comparative Anatomy of Phanerogams and Ferns' has been translated (1885); as also the 'Morphology of Plants' and 'Lectures on Bacteria' (1888).

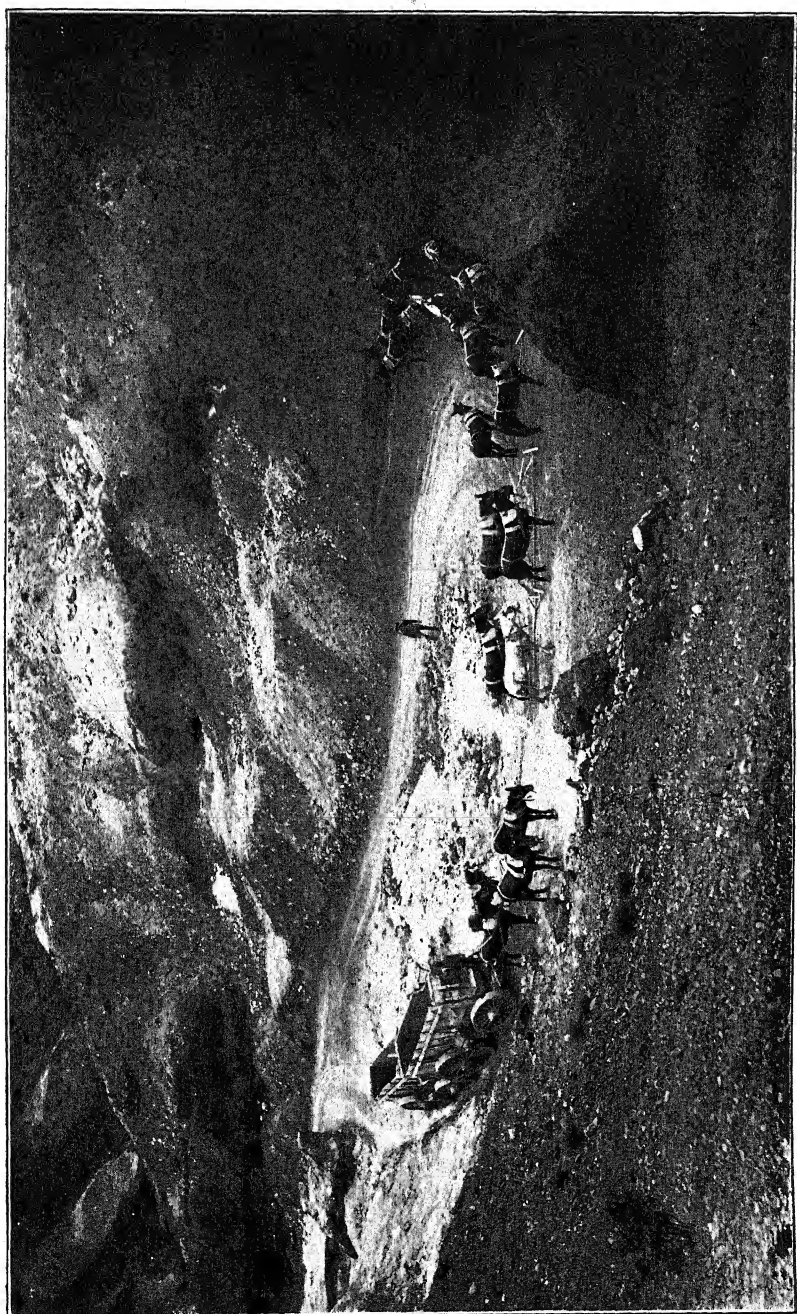
**Debat-Ponsan**, Edouard Bernard, ä-doo-är bār-när dē-bā-pōn-sän, French painter: b. Toulouse 1847. He was a pupil of Cabanel, and although he has produced some noted historical works, is chiefly known as a genre and portrait painter. He won the second grand prize 1872, a medal of the second class 1874, receiving the ribbon of the Legion of Honor 1881, and a bronze medal in 1889. He signed his name Ponsan-Debat until 1880. Among his works are: 'A Story of Philetas' (1870); 'The First Mourning' (1874); 'Jephtha's Daughter' (1876), in the Carcassonne museum; 'St. Paul upon the Arcopagus' (1877); 'Devotion of St. Louis toward the Dead' (1879); 'A Door of the Louvre on St. Bartholomew's Day' (1880); and portraits of Dr. Pichaud (1874); Paul de Cassagnac (1882); Gen. Boulanger; etc.

**Debatable Land**, a district of country on the west border of Scotland and England, for a long time a cause of contention between the two countries and a refuge for outlaws.

**Debay**, Auguste Hyacinthe, French painter and sculptor: b. Nantes 20 April 1804; d. Paris 14 March 1865. He was a son of J. B. J. Debay the elder, and was a pupil of his father and of Gros. He took a medal of the third class 1819 at the age of 15, the second prize of Rome in 1822 with his painting 'Orestes and Pylades'; the first grand prize of Rome with his painting 'Ægisthus Discovering the Body of Clytemnestra,' and a first-class medal in 1831. From 1830 onward he exhibited in all the expositions at Paris, either as painter or sculptor. His principal pictures are: 'The Old Man and His Children'; 'Enlisting at the Place du Palais Royal'; 'The Meeting at the Field of the Cloth of Gold'; 'Attila'; 'Promenade of Sixtus Fifth'; and the 'Battle of Dreux.' As a sculptor he received honorable mention for his 'Napoleon I.' (1841); the first prize in open competition for the monument of Monsignor Affre, now at the Church of Notre Dame, Paris; and a first-class medal at the Exposition 1855 for his best-known work, 'Primitive Cradle'; first shown in 1845. Among other works are statues of Perrault and Claude Lorraine, at the new Louvre; and the marble mausoleum of the Comte and Comtesse de Damas.

**Debay**, Caroline Louise Emma, French painter: b. Paris 24 March 1809; d. there 6 Sept. 1832. She was a sister-in-law of A. H. Debay (q.v.). Among her works are: 'Christina of Sweden'; 'The Village Bride'; and the 'Young Girl Asleep.'

**Debay**, Jean Baptiste Joseph, French sculptor: b. Malines, Belgium, 16 Oct. 1779;





d. Paris 14 June 1863. He was first a pupil of the painter Van Biscoon, then went to Paris and studied under Chaudet. Summoned to Nantes, he made 30 busts for the library, 10 statues for the Exchange, the frontal of the Hotel de Ville, and the statues of Saints Peter, Paul, and John. Returning to Paris 1817, he made two colossal statues of Neptune and Apollo for Havana; and took a second-class medal with a bust of Talma. Among his works are: a bronze equestrian statue of Louis XIV. at Montpellier; statue of the 'Chancellor of the Hospital,' at Aigueperse; marble statue of 'Mercury putting Argus to Sleep' and 'Mercury Preparing to Slay Argus' at Havana; group of the 'Three Fates'; marble statue of Charles Martel, in the museum at Versailles; marble statue of Colbert; 'Young Woman and Shells,' considered his best work; and the figures of 'Ocean' and 'The Mediterranean' for one of the Place de la Concorde fountains. During his later years he held the position of restorer of sculptures at the Louvre. He received the decoration of the Legion of Honor 1825. He executed numerous portrait-busts in excellent style.

**Debay, Jean Baptiste Joseph**, French sculptor: b. Nantes 31 Aug. 1802; d. Paris 7 Jan. 1862. He was the eldest son of the preceding. He was a pupil of his father and of Bosio, and went to Havana at 17 years of age to deliver his father's statues. He took the second prize of Rome 1823, with a bas-relief, 'The Grief of Evander,' and in 1829 the first grand prize of Rome with the 'Death of Hyacinth.' He received the decoration of the Legion of Honor in 1851. Among his works are: 'Theseus'; 'Genius of the Sea'; 'Genius of the Hunt'; 'Young Slave,' first-class medal 1836; 'Anne de Bretagne,' Luxembourg Garden; a bronze statue of 'Cambronne' at Nantes; 'Marshal Oudinot' at Bar-le-Duc; 'Modesty and Love,' marble group; equestrian statue of Napoleon III., at Bordeaux; 'Six Apostles,' church of St. Eustache, Paris; and 10 statues for the Pommeraye Gallery at Nantes.

**Debenture**, in finance, a certificate or document signed by a legally authorized officer, as an acknowledgment of a debt due to some person; a deed or bond of mortgage on certain property for the repayment to a certain person of a certain sum of money advanced by such person, together with interest thereon at a certain stated rate. Debentures are frequently issued by public companies, especially railroad companies, for the purpose of raising money for the completion or carrying on of their undertakings.

In customs, a certificate entitling the person to whom it is granted to a drawback on certain goods exported, the duties on which had been paid.

In public offices, in some government departments, a term used to denote a bond or bill by which the government is charged to pay a creditor or his assigns the money due on auditing his account.

**Deboe, William J.**, American lawyer: b. Crittenden County, Ky., 1849. He was graduated at Ewing College, Illinois, and at the Medical Department of the University of Louisville; practised medicine for a number of years; was admitted to the bar, and practised in Marion, Ky. He was a delegate to the Repub-

lican National Convention which met in Chicago and nominated Benjamin Harrison for the presidency in 1888, and was elected superintendent of the schools of Crittenden County in 1890. He was a member of the State senate 1893-6, and was elected to the United States Senate in 1897-1903.

**Deb'orah**, Hebrew seer or prophetess. She lived in the time of the Judges, and by the aid of Barak delivered the northern tribes from the oppression of Jabin, and secured a peace of 40 years' duration. The triumphal ode (Judges v.) attributed to her is a remarkable specimen of Hebrew poetry.

**De Bow, James Dunwoody Brownson**, American journalist and statistician: b. Charleston, S. C., 10 July 1820; d. Elizabeth, N. J., 27 Feb. 1867. He studied law, was admitted to the Charleston bar in 1844; became a contributor to the 'Southern Quarterly Review,' published at Charleston, and in 1844 took charge of that periodical as chief editor. Among other papers prepared by him for its pages was an elaborate article, published in 1845 upon 'Oregon and the Oregon Question,' which attracted much attention both in this country and Europe. It was translated into French, and was the occasion of a debate in the French chamber of deputies. In 1845 he removed to New Orleans, and established 'De Bow's Commercial Review.' This enterprise proved successful, and the work attained a circulation greater than has ever been reached by any similar publication in the South. In March 1853 he was appointed superintendent of the United States census. In that position he collected and prepared for the press a large part of the material for the quarto edition of the census of 1850. He afterward compiled the volume entitled 'Statistical View of the United States,' a compendium of the 7th census. In 1853 he compiled from his review a work published under the title of 'Industrial Resources of the Southwest.'

**Debraux, Paul Emile**, pöl ä-mël dè-brö, French balladist: b. Ancerville, department Meuse, 30 Aug. 1796; d. Paris 12 Feb. 1831. He was an ardent Republican, and wrote for the common people lively songs of wine and love, sung everywhere in tavern and workshop. He was called "the Béranger of the rabble." His best-known songs are: 'Mt. St. John'; 'Belisarius'; 'Say, Do You Remember?'; 'The Soldier's Widow'; 'Marengo.' Béranger published a complete collection of his 'Songs.'

**Debreczin**, dā-brët'sin, Hungary, a town on the edge of the great central plain of Hungary, about 113 miles east of Budapest. Its houses are mostly of a single story; and in wet weather the wide but unpaved streets become almost impassable from mud. The principal edifices are the Protestant church, and the Protestant college, with a library of 100,000 volumes, Roman Catholic church, town-house, Piarist college, gymnasium, several hospitals, etc. Both the manufactures and trade are important; the former consisting chiefly of coarse woollens, leather, soap, tobacco-pipes, casks, etc., and the latter being in tobacco, wine, flax, hides, wool, potash, cattle, cheese, etc. There are four large fairs annually, and the swine market is the largest in the kingdom. Debreczin is considered the headquarters of Hungarian Protestantism. The Protestant college, founded in 1792, is

## DE BRY — DEBTOR AND CREDITOR

considered the best educational establishment in Hungary. This town suffered much in the wars between the Hungarians and the Turks, and afterward in the religious wars. Pop. (1900) 75,006.

**De Bry, dè-brê, Theodor**, Flemish goldsmith and copperplate engraver: b. Liège 1528; d. Frankfort-on-the-Main, Germany, 1598. He settled in Frankfort-on-the-Main about 1570, and established a printing-house there. The most important of the works issued from his press is the collection of 'Voyages to the East and West Indies,' published in Latin (25 parts, 1590-1634) and German (27 parts 1590-1630).

**Debs, Eugene Victor**, American socialist. b. Terre Haute, Ind., 5 Nov. 1855. He received a common school education and became a locomotive fireman. He was elected to the Indiana legislature in 1885 and was later an official of the Brotherhood of Locomotive Firemen, and, from 1893 to 1897, president of the American Railway Union. He conducted the strike of 1893 in Chicago, and was later sent to jail for contempt, because of his management of the same, though he pleaded innocence of any crime and requested to be tried by a jury and be allowed to summon witnesses in his defence. Since 1897 he has been prominent in the Socialist movement, and in 1900 was the candidate of the Social Democratic party for President of the United States.

**Debt, National**, the amount which a State admits owing to those who have advanced money for the use of the government on occasions when its expenditure has exceeded its income. The amount of a national debt may not be the amount which the nation has borrowed; it is often greater, from the necessity of holding out inducements to capitalists, and also for the increment of interest. When money is bearing low interest, a nation may give its creditors the alternative of receiving payment or allowing a deduction from the nominal amount of their debt. The following table shows the public debts of the nations of the world at the end of the century:

COUNTRIES	Debt	
	Total	Per Capita
	Dollars	Dollars
<b>GOLD STANDARD</b>		
Austria-Hungary .....	2,821,706,000	68.22
Belgium .....	506,853,000	76.95
British Africa .....	185,189,000	37.55
British Australia .....	1,110,465,000	231.64
British Honduras .....	169,000	4.97
British North America .....	72,017,000	14.49
British West Indies .....	20,459,000	13.63
Bulgaria .....	50,612,000	15.28
Costa Rica .....	11,125,000	37.71
Cuba .....	341,726,000	209.39
Denmark .....	56,287,000	25.76
Dutch East Indies .....	481,359,000	49.45
Egypt .....	5,829,742,000	151.12
France .....	2,573,585,000	60.00
Germany .....	3,090,427,000	76.89
Great Britain .....	4,489,000	41.18
Hawaii .....	1,200,448,000	4.13
India and Ceylon .....	201,110,000	4.71
Netherlands .....	470,528,000	94.03
Peru .....	23,798,000	9.08
Rumania .....	249,305,000	42.98
Russia .....	3,837,156,000	35.29
Servia .....	72,017,000	31.13
South African Republic .....	13,278,000	12.12
Sweden and Norway .....	125,688,000	17.92
Switzerland .....	16,438,000	5.33
Uruguay .....	128,850,000	155.62
United States .....	2,104,875,000	28.06

COUNTRIES	Debt	
	Total	Per Capita
	Dollars	Dollars
<i>On a paper basis</i>		
Argentina .....	445,000,000	112.52
Brazil .....	506,400,000	30.51
Chile .....	121,070,000	30.00
Greece .....	157,503,000	13.80
Haiti .....	23,756,000	24.74
Italy .....	2,388,662,000	75.43
Portugal .....	622,895,000	123.34
Spain .....	1,742,857,000	99.22
Turkey .....	726,011,000	32.22
Venezuela .....	37,658,000	15.41
Total gold standard countries .....	32,433,093,000	34.88
<b>SILVER STANDARD</b>		
China .....	200,000,000	.49
Guatemala .....	10,734,000	10.00
Honduras .....	324,30,000	81.08
Hongkong .....	1,700,000	5.31
Mexico .....	83,500,000	6.62
Nicaragua .....	3,000,000	7.14
Persia .....	11,588,000	1.20
Salvador .....	37,605,000	46.77
Straits Settlements .....		
<i>On a paper basis</i>		
Bolivia .....	4,153,000	2.06
Colombia .....	18,301,000	4.59
Ecuador .....	12,500,000	9.83
Paraguay .....	42,941,000	7.01
Total silver standard countries .....	463,621,000	1.03
Grand total .....	32,896,714,000	35.91

**Debtor and Creditor, Laws of.** One of the earliest institutions among men is the right of holding individual property. Upon this right depends the power of making bargains and effecting exchanges. In various ways bargain-making gives rise to deferred engagements, and obligations are incurred which are called debts. These obligations rest upon a double foundation. The right of holding individual property implies the right of recovering any property which has been intrusted to others, or of claiming possession of any property which others have, for a valuable consideration, agreed to make over to us. The primary foundation of debts, therefore, is the right of holding property. A debt is a contract freely entered into. Whether the right of property is valid or not, it is commonly recognized by the person who incurs debt; no abstract doctrine of the rights of property, therefore, can properly come between him and his creditor to justify the violation of an engagement for which he has accepted an equivalent. Credit affords a means by which those who have no property of their own may acquire important advantages through the use of the property of others, and while proprietary rights are recognized, it is of great consequence to society that the obligations incurred in borrowing should be faithfully fulfilled. Hence a very great practical importance is to be attached to the moral obligation implied in the contract of a debt, independently altogether of any abstract or theoretical views which may prevail as to the soundness of the particular institution of proprietary rights on which that obligation may be founded.

In early and rude states of society the natural tendency is to regard all obligations as sacred and inviolable, and all who from any cause fail to fulfil them as criminal in act or intention, either by omission or commission, and liable to

## DEBTS

the most severe and exhaustive punitive treatment. In such a state of society both the primary and secondary foundations of the obligation are likely to be held in extreme estimation. Hence in the earlier stages of society the laws against debtors are universally found to be of the most stringent kind, and as civilization advances, and the relations of society become more complicated, the necessity of repeated modifications of these severe laws becomes apparent. Any modification in favor of the debtor of the consequences of incurring debt, however equitable in itself, necessarily tends to increase the facility with which debt will be incurred, and if these consequences are over-relaxed society will be deprived of a needed protection; debt will be incurred carelessly, and as carelessness borders upon recklessness, and recklessness upon fraud, the lines of distinction between right and wrong dealing will become fainter, the protection due to misfortune, and the condonation necessary to be extended to miscalculation and errors of judgment will become a cover for deliberate conspiracy, and society will become a prey to an organized predatory system of modernized form of highway-robbery, thinly disguised under the forms of commerce. Such are the practical difficulties which the modern theory of the law of debtor and creditor has to encounter.

Among the Jews, under the Mosaic law, debt was treated with great stringency, but there were regulations adapted to discourage the incurring of it, and also some humane restrictions on the power of the creditor after it had been incurred. Lending on usury was forbidden, and the taking of pledges put under severe restriction. The alienation of the estate of an Israelite was also forbidden. The creditor, on the other hand, had power over the person of his debtor, and even over those of his wife and family, and could cause them to be sold in satisfaction of his claim. If the debtor was an alien he might be sold to perpetual bondage, but on the occasion of a jubilee, which was appointed to be proclaimed every 50th year, every Israelitish debtor was set free, and his property, if pledged or sold, returned to him.

Nothing is more common in rude states of society, and under arbitrary and despotic governments, than the liability of the person of the debtor for his debt. This is one of the original sources of slavery. Even in the comparatively enlightened states of Greece and Rome the power of the creditor over the person of his debtor was recognized by law. This power was abolished in Athens by Solon, who is said to have taken his reform from Egypt, where the same unjust law had already run its course. The early Roman law was even more excessive in its indiscriminating severity. By the law of the Twelve Tables the creditors might cut the body of the debtor in pieces and share it among them, they might also sell him and his wife and family to perpetual slavery. In the Middle Ages, notwithstanding the influence of Christianity, the debtor was treated with hardly less severity. Even the Church took the side of the creditor, and the debtor who died without discharge was excommunicated and deprived of Christian burial. As society became more refined the laws against debtors were again gradually ameliorated, but the process was a slow one. Imprisonment for debt in England, except

as an instrument for compelling the surrender of the debtors' effects, was only put an end to in the reign of Victoria.

In the United States originally imprisonment of debtors was adopted as a part of the common law, but at the present time imprisonment for debt, except in case of fraud, or of an absconding debtor, does not legally exist in any of the States. Congress, empowered by the United States Constitution to make a uniform bankrupt law, exercised this power, and subsequently repealed the law of imprisonment; and now, by Revised Statutes 990 and 991, no person can be imprisoned for debt by any process issuing out of the courts of the United States, in any State where by the laws of the State imprisonment for debt has been abolished. Most of the States, by constitutional provision, have prohibited arrest or imprisonment for debt, while the other States, either by direct statutes prohibiting imprisonment for debt, or by poor debtors laws, or by insolvent laws, secure the same result; it being held to be against public policy to deprive a man, by imprisonment, of the power to pay his debts, and make him a direct charge upon the State.

**Debts, United States Public.** These consist of the debts contracted by the nation, the States, and municipalities.

*National.*—The nation has contracted eight principal debts in its existence, which have overlapped each other and been complicated with incidental loans for special purposes. Five of these were for wars,—that of Independence, the War of 1812, the Mexican war, the Civil War, and the Spanish-American war; the present national debt is mainly for the Civil War. The other three were due to the commercial panics of 1837 and 1857, and the imminent silver bankruptcy of 1893.

At the close of the Revolution, the United States owed to foreigners \$10,313,505.91,—\$6,352,000 for French government loans, \$3,600,000 for Dutch loans, \$174,017.13 for Spanish bankers' private loans, and \$186,988.78 for 6 per cent certificates of indebtedness to French officers who had served in the Revolution. The domestic debt was upward of \$35,000,000; including some \$600,000 for funding of about \$6,000,000 Continental paper money at a cent on the dollar, and about \$2,000,000 in Continental bills of credit. Besides these, the States owed debts which, when they were taken over by the national government under the Constitution, 4 March 1789, were arbitrarily estimated at \$21,500,000, and actually assumed at \$18,271,786.47. At this time, the principal and arrears of interest on the foreign debt were \$11,710,378.62; of domestic debt, \$40,414,085.94 (nearly a third of it unpaid interest); making, with the bills of credit and the State debts, an aggregate officially stated in 1791 as \$75,463,476, at four and five per cent interest, and thus creating a total interest charge of \$4,587,444.81. This aggregate fluctuated around \$80,000,000 for many years, the new navy, the Barbary wars, and the Indian wars, etc., preventing much reduction. It reached a maximum of \$86,427,120 in 1804, as a result of borrowing part of the \$15,000,000 for the Louisiana Purchase. From thence to 1812 it was steadily paid off by an average installment of \$5,000,000 a year, till it had dropped to \$45,209,737. Then the war with England



## DEBTS

intervened, and the debt was not finally closed out till 1834.

The War of 1812 cost \$80,500,073.50 in loans which yielded only some \$34,000,000, owing to the country's poor credit; and the debt in 1816 stood at \$127,334,933. Thenceforward till 1834 it was paid off by a sinking fund and redemptions, with only one interruption: in 1821 \$5,000,000 was borrowed to pay the award under the Florida treaty, and the debt rose \$3,500,000, to \$93,546,676. In 1830 it was \$48,565,406; in 1832, \$24,322,235; in 1833, \$7,001,698; in 1834, \$4,760,082; and the next two years saw only \$37,513 on the books, not at once redeemable. This extinction left some \$40,000,000 surplus in the treasury, of which \$37,468,819.97 was deposited unsecured in State banks. The consequent inflation and wild-cat banking, with Jackson's fluctuating and reckless financial methods, caused a crash and panic in 1837, and the fourth quarter's installment could not be, and never has been, repaid. The government had to borrow more money, and after this was paid new government enterprises were undertaken. From \$3,308,124 in 1838, the debt grew to \$23,461,652 in 1844, with a temporary increase of \$12,000,000 the year before; the next year \$7,500,000 were cleared off, and in 1846 the balance due stood at \$15,550,202. Then came the Mexican war: its cost, and the money paid for cessions of territory, raised the debt to \$63,061,858 in 1849, and to \$68,304,796 in 1851. Payments on the principal now began again, and in 1857 had reduced it to \$28,699,831. The panic of that year and the commercial depression thenceforward again forced a resort to borrowing,—\$20,000,000 at five per cent 1858, \$21,000,000 six per cents in 1860. This indebtedness was shortly afterward increased by the War loan. By 1860 the debt stood at \$64,842,287.

The history of the debt through the Civil War is a financial record which it is difficult to keep separate from a general history of currency, so many devices were utilized in the way of paper money, from postage stamps to interest-bearing bonds circulating as cash. The first loan was negotiated in February 1861, before the actual outbreak of the War. Of \$25,000,000 authorized, only \$18,415,000 worth of bonds were issued, at six per cent for 20 years; and even these could not command par. On 2 March \$35,364,450 in two-year six per cent treasury notes, receivable for customs, were issued. On 17 July 1861 the first great loan was authorized with full sense of the magnitude of the task before us: \$250,000,000 20-year seven per cents; the Treasury having authority to issue any part of it in three-year 7.30 per cent treasury notes (the "seven-thirties"), or in demand notes without interest not to exceed \$50,000,000, or in one-year 3.65 per cents. On 5 Aug. 1861 an issue of six per cent 20-year bonds was authorized in exchange for the one- and three-year bonds, and the demand notes made receivable for all government dues; this brought the latter from a condition of unsalability to the command of a premium, and the former were readily bought in exchange for the short-term notes. The issue of 7.30's reached \$140,094,750, the 3.65's sold largely, and the entire \$50,000,000 of demand notes were taken, while the 20-year six per cents had an issue of \$189,321,200. On 12 Feb. 1862, \$10,000,000 more demand notes were issued. In that month also the first of the

great popular loans was put on the market, the famous "five-twenties" (redeemable after 5, and payable after 20 years). They were six per cents, and the \$500,000,000 authorized was issued in full. Fifteen million dollars more were issued 1864-5. On the 25th of the same month, the first issue of "greenbacks" to the amount of \$150,000,000 was made, on 11 July another of equal amount appeared, and on 3 March 1863 still another,—\$450,000,000 in all. Of these, \$400,000,000 were made permanent, but contractions in 1868 and 1869 reduced their volume to \$346,681,016. Several acts, one of this same financially memorable February 1862, authorized the receipt of deposits at five per cent, and the amount was fixed at \$100,000,000 on 11 July; on 30 June 1864 another \$50,000,000 was authorized, at six per cent. These were all redeemable at 10 days' notice, and redeemed in 1865 and 1866. The success of these loans in 1861-2 had been marvelous; but their magnitude had strained the public credit and resources, and various other means were adopted. In March 1862 one-year six per cent certificates of indebtedness to public creditors were authorized, and \$561,753,241 were issued, all redeemed by 1866. In March 1863 the first fractional currency was authorized, postage stamps having been hitherto used as such; a \$900,000,000 gold loan was authorized, but only \$75,000,000 was issued; and \$400,000,000 more in treasury notes for one, two, and three years, of which \$477,595,400 was issued; namely in one-year five per cents, \$44,520,000; in two-year five per cents, \$166,480,000; in three-year six per cents, \$266,595,400. These notes were canceled or exchanged by 15 May 1868. In March 1864 the "ten-forties of 1864" were authorized: \$200,000,000 of five or six per cent gold bonds, redeemable in 10 and payable in 40 years. Of these, \$196,117,300 were issued at five per cent, and \$3882,500 at six per cent. In June 1864 the issue of the "five-twenties of 1864," six per cents, was authorized up to \$400,000,000, but only \$121,561,300 was issued. The same month, \$200,000,000 of 7.30 treasury notes were authorized, increased in March 1865 to \$800,000,000; in all, \$829,992,500 of 7.30's was issued; all were redeemed by July 1868. After this, several large loans in six per cent five-twenties were made, and loan certificates of deposit were issued; but as they were intended exclusively to redeem treasury or compound-interest notes, and did not increase the public debt, they belong to a history of government finance, not of the debt. In July 1870 a refunding act was passed, to enable the government obligations at high interest to be replaced by others at lower rates.

The amount of the national debt in 1862 was \$524,176,412; in 1863, \$1,119,772,139; in 1864, \$1,815,784,370; in 1865, \$2,680,647,870; in 1866, \$2,773,236,174. This was the climax; thenceforward, with interruptions only during the long depression of 1873-8, it steadily declined, till 1893. In 1881 it was \$2,053,353,961; in 1893, \$1,545,996,591. At this time the threatened bankruptcy of the Treasury, owing to the enormous accumulations of silver under the Sherman Act, compelled a fresh issue of bonds to preserve the national credit, by increasing the gold reserve. These were five per cents; in 1898 an issue of three per cents was made for the Spanish War. In 1902, exclusive of \$860,316,569 of certificates and treasury notes offset by an equal amount of cash in the Treasury, the debt was

\$1,314,929,599.89; in all \$2,175,246,168.89. Of this, the interest-bearing debt was \$915,370,230, and the interest charge about \$30,000,000, as against \$151,000,000 in 1865. Of course, not only has the principal of the debt declined, but the interest rates even more: government three per cents command a heavy premium, and by the act of 14 March 1900 the bonds of all rates were made convertible into two per cents.

*State.*—The latest returns of State bonded debts show a grand total of \$177,559,948. After the assumption of their debts by the national government, the States incurred none of moment till they contracted small loans to assist the government in the War of 1812. They did not attempt any considerable loans for internal improvements till about 1820, but in the next five years had aggregate debts of \$12,790,728. In 1830 the total had increased to \$26,470,417; in 1835 during the great western "boom," it had risen to \$66,583,186; and in the frantic speculation of the three years, 1835-8, \$107,823,868 were added to it. By 1840 it was over \$200,000,000. But the improvements in western lands thus effected, though in the main good and useful, and some of them since profitable, had far outrun the immediate ability of the property developed to pay for them: several States defaulted principal or interest, or both, and as the Constitution had forbidden States to be sued in the courts, the foreign bondholders were without recourse when they repudiated their obligations. The chief offenders were Pennsylvania, Maryland, Michigan, Indiana, Illinois, Mississippi, and Louisiana. America was an unsavory name in foreign parts, and none the less so that some of the State leaders attempted justifications which the creditors thought impudent dishonesty. From 1840 on, a strong effort was made to have the general government assume the debts once more; in December 1842 a select committee of Congress was appointed to report, which it did the following March; the total amount then was \$207,894,613.35, and the interest charge \$10,394,730.64. There were too many obstacles, and the plan fell through: the solvent and prudent States were not inclined to saddle themselves every few years with the obligations of those not so. As a fact, however, the States have not since abused their opportunities. The only cases of repudiation since have been among the Southern States plundered by the "carpet-bag" governments, and saddled with debts at once fraudulent and impossible of payment; though one or two have taken advantage of this plea to repudiate debts not owing to the carpet-bag régime and not difficult of payment. In 1880 the combined State debts amounted to \$250,722,081; so that they have been reduced by nearly one fourth within a generation, although not wholly by being paid. Nearly every State in the Union now has constitutional prohibitions from borrowing over a certain amount or percentage for public purposes.

*Municipal.*—The total debts of the 100 largest cities of the United States foot up about \$845,000,000; of which New York has considerably over one third, namely \$311,829,916. More than \$100,000,000 more is held by two others, Boston (\$51,869,954) and Philadelphia (\$50,055,395), the three together carrying nearly half the entire municipal debt of the country. None others have even half so much as either of the two latter: and singularly, the fourth in

the list, Cincinnati is only tenth in nominal, though higher in actual population. She has \$27,081,254; while Chicago, the second in population, has \$23,710,000. Cleveland, St. Louis, Baltimore, New Orleans, Buffalo, and Jersey City, in order, with \$18,000,000 to \$16,000,000, have together about \$103,000,000. These 11 cities have in all about \$568,000,000, or two thirds of the entire United States municipal debt. Washington, Newark, and Pittsburg are the only others which have over \$10,000,000. It must be remembered that there are sinking funds which heavily reduce this total; and that most of it has been contracted for conveniences or beauties which attract population and so reduce taxes. More than one fifth of the whole, indeed, is for water-works, which are not in any proper sense debts at all, as the water is paid for directly. The water-works systems of the country represent probably close on \$200,000,000 of investment. About six per cent is for parks and public places, nearly as much for bridges and harbor improvements, about 10 per cent for railroad aid, and nearly four per cent for public buildings. A great number of municipalities also are forbidden by law to incur above a certain fixed or contingent amount of debt.

**Début**, dā-bû', a French word which has been adopted into the English language, signifying generally a beginning or entrance, but specially applied to the first appearance of an actor or actress on the stage, or to a first appearance in a particular theatre. In these circumstances, the actor is called a *débutant*; the actress, a *débutante*. The expression is very frequently used with reference to a young lady's first entrance into society.

**Deca** (Gr. signifying "ten"), a prefix of frequent occurrence; as in *Decapolis*, a group of 10 cities; *decalogue*, the 10 commandments; *decametre*, a measure of 10 metres, etc. From *deca* is formed *decade*, a collection or group of 10. In the calendar of the French Republic the term decade was used to designate the week of 10 days, which were severally named *primidi*, *duodi*, *tridi*, *quartidi*, *quintidi*, *sextidi*, *septidi*, *octidi*, *nonidi*, and *decadi*. See CALENDAR.

**Decachord**, dēk'ā-kōrd (Gr. *dekachordos*, ten-stringed), an ancient Greek instrument of 10 strings, triangular in shape; also a kind of large guitar with 10 strings.

**Decade** (Latin, *decas*, from the Greek *deca*), a group or division of 10, especially a period of 10 years, a decennium. The books of Livy are divided into decades. In the French Revolution, decades, each consisting of 10 days, took the place of weeks in the division of the year. See CALENDAR.

**Decadents, The**, a school of artists and writers, the followers of which delight in the more or less morbid refinements of feeling and style, and pride themselves upon this perversion of taste. The decadent is fond of the products of declining civilization corrupted by many centuries of culture, of works too highly seasoned and vitiated, which presage the final dissolution of a social order fallen into decrepitude, and shuns the simple, the natural, the healthful, clinging only to the artificial and the complicated in life and character. The name of decadents may rightly be given to those who make a subtle virtuosity out of art. Among French writers

## DECALOGUE—DE CANDOLLE

Baudelaire was the first theorist of this school, and his influence was felt by many writers of the "end of the century," such as the Goncourts and Maurice Barres. The decadents' school of poetry is best represented by Stéphane Mallarmé and Verlaine, and its disciples are numerous, including many men of undoubted talent who have combatted the stiffness and dryness of the Parnassians, not without success. They are often termed delinquents and symbolists; the latter term is well chosen as indicating their aims and manner.

**Decalogue**, the Ten Commandments, called by the Hebrews Ten Words, of which Decalogue (*oi δέκα λόγοι*) is a literal rendering. In all versions of these Ten Words whether as taken from Exodus xx. or from Deuteronomy v., there is essential verbal agreement; but the precepts are differently distributed by the Latin Church and the Lutheran on one hand, and the Greek Church and the Reformed on the other; and the Church of England stands with the Reformed, or the churches of Calvinian descent. What in the Roman Catholic and the Lutheran arrangement of the Decalogue is the first commandment is in the arrangement adapted by those other bodies the first and second; and what in the Roman Catholic and Lutheran arrangement is the ninth and tenth is for the others the tenth. In this distribution of the matter of the Decalogue some Protestant controversialists describe an endeavor on the part of the Roman Church to evade the prohibition of image-worship, in particular, because in a necessarily succinct popular formula of the first commandment no mention is made of images: "I am the Lord thy God: thou shalt not have strange gods before me." But it is replied that the inculcated division and distribution of the matter of the Decalogue is not peculiar to the Roman Church, for in the Talmud, the Targum of Jonathan, and in the writings of many rabbinical commentators the prohibition of worship of strange gods and the prohibition of worship of images are classed as one commandment, or one "word," the second, for they regard the proemium, "I am the Lord thy God, etc.," as the first "word" but they comprise in the tenth commandment the prohibitions of the 9th and 10th of the Roman Catholic scheme. The Lutheran scheme is in accord with that of the Latin Church, save that it follows the order of the prohibitions of covetousness given in Deuteronomy, not that in Exodus, which is the order followed by the Latin Church.

**Decameron**, *dē-kām'ē-rōn*, anything of 10 days' occurrence; also the title given to a collection of tales by Boccaccio, written in 10 parts, each part containing 10 stories, and being supposed to occupy one day in the narration. Boccaccio represents the stories as being told by seven ladies and three gentlemen, who had fled from Florence into the country to escape the fearful plague of 1348, and who had no other means of passing the time.

**De Camp**, John C., American naval officer: b. New Jersey 5 Oct. 1812; d. Burlington, N. J., 24 June 1875. He entered the navy in 1827; served in the frigate *Constitution* off the coast of Africa in 1854, and received the rank of commander the next year. During the Civil War he had command of the steam sloop *Iro-*

quois in the attack on Fort Jackson and Fort Philip, and served on the Mississippi under Farragut, distinguishing himself especially at Vicksburg. In 1868-9 he commanded the receiving ship *Potomac*, and was retired in 1870.

**Decamp**, Joseph Rodefer, American landscape and figure painter: b. Cincinnati 5 Nov. 1858. He was a pupil of Frank Duvenant in Munich and became a member of the American Society of Artists. His landscapes, though generally realistic in treatment, show the influence of impressionistic methods.

**Decamps**, Alexandre Gabriel, *ä-lëks-ändr gä-brë-el dë-kän*, French painter: b. Paris March 1803; d. Fontainebleau 23 Aug. 1860. He was educated in the studio of Abel de Pujol. When a young man he made a journey to the East, and returned from thence with a collection of sketches, from which he afterward produced some of his finest pictures. Among the more celebrated of these are: 'The Grand Bazaar'; 'Relieving Guard at Smyrna'; 'A Turkish Café'; 'Turkish Children Going Out of School'; and 'Arab Horsemen Passing a Ford.' Of pictures of another class are: 'The Shepherd and His Flock Overtaken by a Storm'; 'An Italian Village'; 'The Hawking Party'; 'Spaniards Playing at Cards'; 'Don Quixote and Sancho Panza.' Decamps also produced some historical and sacred pictures of a high order of art, including the 'Defeat of the Cimbri'; 'The Miraculous Draught of Fishes'; 'Joseph Sold by His Brethren'; 'The Finding of Moses'; and others. The leading merits of this painter are great originality of conception and vigor of expression, with a wonderful skill in the treatment of light and shade.

**De Candolle**, Alphonse Louis Pierre Pyrame, *äl-fōns loo-ë pë är pë-räm dë kään-döl*, Swiss botanist: b. Paris 28 Oct. 1806; d. Geneva 4 April 1893. He was a son of Augustin De Candolle (q.v.) and also published several works of note, the most important being: 'Geographical Botany' (1855) and 'Origin of Cultivated Plants' (1883). He also edited the 'Memoirs' of his father (1862).

**De Candolle**, Augustin Pyrame, Swiss botanist: b. Geneva 4 Feb. 1778; d. there 9 Sept. 1841. He studied chemistry, physics, and botany in Paris, where in 1797 his earliest work, on lichens, was published. Other works quickly followed, including his 'Astragalogia' (1802) and his valuable 'Essays on the Medicinal Properties of Plants' (1804). In 1802 he was elected to an honorary professorship in the Academy of Geneva, but remained in Paris, and delivered his first botanical lectures in the Collège de France in 1804. His 'French Flora' appeared in four volumes in 1805. Employed by the government, he visited all parts of France and Italy in 1806-12, investigating their botany and agriculture. The results of his journeys are partly embodied in a supplement to the 'Flore.' He was appointed in 1807 to a chair at Montpellier, where he lived from 1810 to 1816; he then retired to Geneva, where a professorship of botany was founded for him, and where he spent the remainder of his life. De Candolle was an industrious writer, and the fruits of his studies in systematic botany and the properties and natural affinities of plants are embodied in a considerable number of works. The greatest of

these, his 'Natural System of the Vegetable Kingdom' (Vols. I. and II. 1818-21), was commenced on too grand a scale, and was continued within more reasonable limits in the 'Preliminary View of the Natural System of the Vegetable Kingdom' (17 vols. 1824-73, the last 10 by his son and others).

**Decap'olis**, the name of an ancient country of Palestine, lying on both sides of the Jordan, and containing 10 principal cities, whence its name.

**De Cassagnac, Paul Granier.** See GRANIER DE CASSAGNAC, PAUL.

**Decatur, Stephen**, American commodore: b. Newport, R. I., 1751; d. Philadelphia 14 Nov. 1808. During the war of the American Revolution he commanded several privateers, and acquired some reputation by the capture of English ships. At the commencement of hostilities with France in 1798, he was appointed to the command of the Delaware of 20 guns, in which ship he cruised during the years 1798-99 on the American coast, and in the West Indies, capturing at different times the French privateers *Le Croyable* of 14, and *Marsuin* of 10 guns. In 1800 he commanded a squadron of 13 sail on the Guadeloupe station, the Philadelphia, a frigate of 38 guns, being his flag ship.

**Decatur, Stephen**, American commodore: b. Sinnepuxent, Md., 5 Jan 1779; d. near Bladensburg, Md., 22 March 1820. He was of French descent, the son of the preceding, and obtained a midshipman's warrant in 1798. He saw some service against the French, and was commissioned lieutenant in the following year. In the war with Tripoli (1801-5), he gained great distinction, his brilliant achievement of boarding and burning the captured Philadelphia in the harbor of Tripoli, and then escaping under the fire of 141 guns, Nelson pronounced "the most daring act of the age." For this he received his commission as captain in 1804; in 1810 he was appointed commodore. In the war with England in 1812 he captured the frigate *Macedonian*, but in 1814 he was obliged to surrender, after a resistance that cost him a fourth of his crew, to four British frigates. In 1815 he chastised the Algerines for their piracy, and compelled the bey to declare the American flag inviolate; and he obtained indemnities for violating treaty stipulations from the bey of Tunis and the pasha of Tripoli. He was appointed a navy commissioner in 1816, and was killed in a duel by Commodore James Barron.

**Decatur, Ala.**, city, county-seat of Morgan County; on the Tennessee River and the Louisville & Nashville, and Memphis & Charleston railroads; 75 miles north of Birmingham. It has extensive manufactures of lumber, iron, flour, cotton, and leather. Pop. (1900) 3,114.

**Decatur, Ga.**, town, county-seat of De Kalb County; on the Georgia Railroad; six miles east of Atlanta. It is a noted resort on account of its fine climate; is the seat of the Agnes Scott Institute for Young Ladies, and has newspapers and electric lights. A battle was fought here, 20 July, 1864, between a portion of Sherman's army, under Gen. Thomas, and the Confederates under Gen. Hood, the latter retreating at nightfall. Pop. (1900) 1,418.

**Decatur, Ill.**, city, county-seat of Macon County; near the Saugamon River, and on the

Wabash, the Illinois Central, the Cincinnati, Hamilton & Dayton, and the Vandalia R.R.'s; 173 miles southwest of Chicago and 38 miles east of Springfield. It was settled in 1830 and in 1836 was incorporated. Decatur is in the midst of the famous Illinois corn belt, and is the trade centre of several counties. The chief manufacturing establishments are corn mills (the largest in the United States), railroad shops, iron works, flour mills, planing mills, agricultural implement works, engine and boiler works, casket and coffin factories, bridge works, and mantle factories. The Government census of 1900 gives the number of manufacturing establishments, 239; the capital invested \$3,632,263; the number of wage earners, 2,313; the annual wages, \$994,659; the cost of material, \$3,690,802; and the value of the products, \$5,896,492. The city has a large trade in grain, coal, live-stock, and manufactured products.

The principal public buildings are the Government building, the county court-house, the municipal buildings, Saint Mary's Hospital, the churches (about 25 buildings), and the schools. There is a good system of public schools, including a well equipped high school. There are two parish schools. The principal departments of the James Milliken University are located here. There are three National banks. The government is administered under a charter of 1886 which provides for a mayor, who holds office two years, and a city council. The majority of the administrative officials are appointed by the mayor. The city attorney, treasurer, and clerk are elected by the people. The city owns and operates the electric light plant and the water-works. Pop. (1890) 16,841; (1900) 20,754.

E. A. GASTMAN,

*Supt. of Schools of Decatur, Ill.*

**Decatur, Ind.**, city, county-seat of Adams County; on the Saint Marys River, and the Toledo, Saint Louis & Kansas City and Erie railroads; 20 miles southeast of Fort Wayne, and near the eastern boundary of the State. Its principal industries are the manufacturing of lumber and machinery, and stone-quarrying. Pop. 4,142.

**Decatur, Texas**, town, county-seat of Wise County; on the Fort Worth & Denver Railroad; 45 miles northwest of Fort Worth. The town is the trade centre of an agricultural region, and its industries are chiefly those of a cotton-growing country, with the quarrying of limestone. The Northwest Texas Baptist College is located here. Pop. 1,562.

**Decazes, Elie**, â-lê dê-kâz, Duc, French statesman: b. St. Martin du Laye, Gironde, 28 Sept. 1780; d. Decazeville, France, 25 Oct. 1860. He gained the confidence of Louis Bonaparte, king of Holland, whom he served even after his abdication in 1810, but joined the cause of the Bourbons in 1814, and under the second restoration discharged the duties of prefect or police at Paris with marked ability. In 1818 he became home minister, and in November 1819, premier. On the occasion of the assassination of the Duke de Berry, in 1820, a deputy charged him openly with being an accomplice of the murderer; and Châteaubriand, then an ultra royalist, wrote in the *Conservateur*; "His foot slipped in the blood." He then resigned, when Louis

XVIII. made him a duke, and his ambassador to England, where he remained till December 1821. Under the reign of Charles X. he opposed the extreme measures of the government, and after the revolution of 1830, adhered to Louis Philippe. In 1834 he was appointed grand referendary of the chamber of peers, and in 1848 retired from public life.

**Deccan**, dĕk'kan, a term, rather of historical interest than of actual use, applied sometimes to the whole peninsula of Hindustan to the south of the Vindhya Mountains, which separate it from the basin of the Ganges; and sometimes restricted to that portion of the same which is rather vaguely bounded on the north by the Nerbudda, which falls into the Gulf of Cambay, and on the south by the Kistna or Krishna, a tributary of the Bay of Bengal. By Deccan peninsula is meant Hindustan.

**Deceased Wife's Sister Marriage Bill**, a bill to legalize marriage between a man and the sister of his deceased wife that has been brought up in almost every session of the British Parliament since 1835, when Lord Lyndhurst secured the passing of a bill, which declared all such marriages null and void. The bill legalizing marriage with a deceased wife's sister has passed the House of Commons several times, but till 1896 was invariably rejected in the House of Lords, with, however, decreasing majorities. In 1896 the bill was passed by the lords, but went no farther. The Colonial Bill passed in the House of Commons more than 20 years ago, and in the House of Lords during the session of 1898, to make marriages of this class legally contracted in the colonies legal also in England, and the Scotch Bill, having a similar object, has also never been carried, though there are not wanting high authorities who pronounce such marriages legal in Scotland even now, without any special permissive legislation. It may be added that marriage with a deceased wife's sister has been specially legalized under the sanction of the Crown in all the Australian colonies, in Canada, Barbadoes, Ceylon, Mauritius, New Zealand, South Africa, and Jersey. Bills similar to the English bill have also been passed in Natal. These were, however, refused ratification (by the Crown) for special or technical reasons. Throughout India marriages of this kind are universally legal among all sects and creeds, except British subjects whose domicile is Great Britain. In every Christian country in the world, except Great Britain, such marriages are legal.

**Decebalus**, the name of several Dacian kings, or perhaps a general title of honor borne by them. One of them, according to Dion Cassius, distinguished himself by his opposition to the Roman arms during the reigns of Domitian and Trajan. He entered the province of Moesia, defeated and killed Appius Sabinus, the Roman governor, and captured many important towns and fortresses. Domitian, whose prætorian prefect, Cornelius Fusus, Decebalus had defeated and slain in a disastrous battle, agreed to pay him a yearly tribute, which was continued by Nerva, but refused by Trajan, who subdued Dacia, assumed the victorious title of Dacius, while Decebalus, to escape falling into the hands of his conquerors, took his own life.

**December**, the 12th month of our year, from the Latin *decem*, ten, because in the Roman year instituted by Romulus it constituted the 10th month, the year beginning with March. In December the sun enters the tropic of Capricorn, and passes our winter solstice. This month was under the protection of Vesta.

**Decemvirs**, dĕ sĕm'vĕrz, the 10 men appointed to codify the laws of ancient Rome. Commissioners were sent to Greece to study Greek statute law, and on their return (302 B.C.) all the magistracies were suspended, and a commission of 10 patricians (*decemviri legibus scribendis*) appointed with consular powers to reduce the laws to writing. The finished code, after being ratified by the comitia of the centuries, was erected in the Forum inscribed on 10 tables of wood. Next year the decemvirate was renewed, and added two tables. The whole code was known as the Twelve Tables (q.v.). The president of both the decemvirates was Appius Claudius (q.v.).

**Deception Island**, a volcanic island belonging to the South Shetland group in the Antarctic Ocean, directly south of Cape Horn. Amid its ice-covered rocks lies a crater-lake, five miles in circumference, surrounded by hot springs.

**Dechamps**, Adolphe, ä-dōlf dĕ-shān, Belgian journalist and statesman; b. Melle 17 June 1807; d. near Brussels 19 July 1875. Early in life a disciple of Lamennais, he subsequently became an orthodox Roman Catholic. From 1843 to 1845 he was minister of public works, and from 1845 until August 1847, when the triumph of the liberal party led to his secession, minister of foreign affairs. From 1837 to 1851 he conducted the Catholic 'Revue de Bruxelles,' founded by himself and Dedecker. He was an able administrator and an influential parliamentary speaker. He was the author of: 'L'Empire et l'Angleterre' (1860); 'La France et l'Allemagne' (1865); 'Le Prince de Bismarck et l'entrevue des trois empereurs' (1873).

**Deciduous** (Lat. *deciduus*, that falls down, from *decidere*, fall down, from *de*, down + *cadere*, fall), in botany, a term applied to various organs of plants, particularly leaves, to indicate their annual or periodic fall. When the calyx of a flower falls with the corolla it is called deciduous; when it falls on the expansion of the flower it is called caducous. Deciduous trees are those which for the most part annually lose and renew their leaves. In cold and temperate countries the fall of the leaf in autumn and the restoration of verdure to the woods in spring are among the most familiar phenomena of nature, connecting themselves also very intimately with the feelings, habits, and circumstances of mankind. The greater part of the trees and shrubs of temperate regions are deciduous; but within the tropics the forest retains always its luxuriance of foliage, except in countries where the dry season is extremely marked. There many trees lose their leaves in the dry season, and exhibit the same partial suspension of vegetative life. In warm countries the leaves of deciduous trees frequently remain for two or more years. Trees not deciduous are called evergreens, and evergreens never lose all their leaves at once.

**Deciduous Teeth.** See **TEETH**.



## DECIMAL ARITHMETIC—DECKEN

**Decimal Arithmetic**, the common system of arithmetic, in which the figures or digits ranged in a row, increase in value by a multiple of ten as they are read from right to left, and decrease at a similar ratio from left to right. Also that part of the science of numerical calculation which treats of decimal fractions. See FRACTIONS.

**Decimal Fraction**, a fraction whose denominator is a decimal or power of 10. Thus

$\frac{1234}{100}$  is a decimal fraction. It may be decom-

$$\begin{array}{r} \text{posed into the sum} \\ \frac{1000}{100} + \frac{200}{100} + \frac{30}{100} + \frac{4}{100} \\ -10 + 2 + \frac{3}{10} + \frac{4}{100} \end{array}$$

By an obvious extension of the method of local values, where each digit has 10 times the value of the like digit, which immediately succeeds it the above decimal fraction may clearly be written more concisely in the form 12.34, where the decimal point after the 2 merely serves to indicate which digit represents units.

In this abbreviated form a decimal fraction is termed a decimal. For the purpose of indicating the unit's place, other and less objectionable methods have been proposed. The operations of addition, subtraction, multiplication, and division may be applied to decimals in exactly the same manner as to integers; hence their great utility. They present, nevertheless, this disadvantage, that comparatively few fractional quantities or remainders can be exactly expressed by them; in other words, the greater number of common fractions cannot be reduced, as it is called, to decimal fractions, without leaving a remainder.

Common fractions, such as  $\frac{1}{2}$ ,  $\frac{3}{4}$ ,  $\frac{1}{3}$ ,  $\frac{2}{3}$ , and  $\frac{5}{8}$ , for instance, can be reduced to decimal fractions only by multiplying the numerator and denominator of each by such a number as will convert the denominator into 10, or 100, 1,000, etc. (The common process is merely an abridgment of this.) But that is possible only when the denominator divides 10 or 100 without remainder. Thus, of the above denominators, 2 is contained in 10, 5 times; 4 in 100, 25 times; and 25 in 100, 4 times; therefore,

$$\begin{array}{l} \frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10} = .5; \quad \frac{1}{4} = \frac{1 \times 25}{4 \times 25} \\ \frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = .75; \quad \frac{1}{3} = \frac{1 \times 33}{3 \times 33} = \frac{33}{99} = .33 \\ \frac{2}{3} = \frac{2 \times 33}{3 \times 33} = \frac{66}{99} = .66; \quad \frac{5}{8} = \frac{5 \times 125}{8 \times 125} = \frac{625}{1000} = .625 \end{array}$$

But neither 3 nor 7 will divide 10 or any power of 10; and therefore these numbers cannot produce powers of 10 by multiplication. In such cases we can only approximate the value of the fraction.

**Decimal System.** See METRIC SYSTEM.

**Decima'tion**, in war, the selection of the tenth man of a corps by lot for punishment, as in case of a mutiny. It was early practised by the Romans. Sometimes every tenth man was executed; sometimes only one man of each company, the tenth in order, as was the case when the Saxons mutinied against Blücher before the battle of Waterloo.

The practice was followed by Essex at Dublin (1599), by the Austrians at Leipsic (1642), and by the French at Trèves (1675). The term is frequently used in a loose way for the destruction of a great but indefinite proportion of people, as of an army of inhabitants of a country.

**Decip'ium**, or **Decip'ium** (Lat. "deceptive"), a metallic element discovered by Delafontaine in the mineral samarskite, and also observed by him in sipylite. Decipium is not yet universally recognized among chemists as entitled to a place in the list of elements, but the symbol Dp has been assigned to it, and its atomic weight has been found to be about 171, if (as appears probable) its oxid has the formula  $Dp_2O_3$ . If the formula of the oxid is  $DpO$ , then the atomic weight must be taken as about 106. Decipium is said to possess properties that are very similar to those of cerium and gadolinium. It forms colorless salts, the acetate being easily crystallizable. The double sulphate of decipium and potassium is insoluble in a saturated solution of potassium sulphate, and advantage has been taken of this fact to effect the separation of decipium from terbium.

**Decius, Gaius**, gā'yūs dē'shī-ūs, **Messius Quintus Trajanus**, Roman emperor: b. Bubalia, Pannonia: d. 251 A.D. He reigned from 249 A.D. to 251 A.D. He persecuted the Christians, and perished with his army in a bloody battle near Abricium against the Goths, through the treachery of Gallus, who succeeded him as emperor.

**Decius Jubellius**, Roman general. He was appointed to the command of the Campanian legion, which had been stationed at Rhegium for its protection 281 B.C. Under pretext that the inhabitants were intending to betray the garrison to Pyrrhus, he perpetrated the greatest atrocities. Shortly after, having been attacked by a disease in his eyes, he sent to Messina for a physician, who happened to be a native of Rhegium. The physician, to revenge the cruelties inflicted on his countrymen, prescribed an application, enjoining Decius to continue it, however painful it might be, till the physician again returned. The pain became insupportable, and at length Decius found that his sight was destroyed. To complete his punishment, the Romans gave effect to the complaints of the citizens, and he perished by his own hands in a Roman prison.

**Decius Mus**, mūs, **Publius**, Roman consul. In a war against the Latins 340 B.C., he devoted himself to death for his country, that is, after certain rites, rushed into the midst of the foes to certain death. His example was followed by his son, and, according to some historians, by his grandson. Such acts of self-devotion (*devotiones*) were not unusual at that time, when patriotism and piety exerted a powerful influence.

**Deck**, a horizontal platform or floor extending from stem to stern of a ship and covering in the hold. In ships of large size there are several decks one over the other. The topmost deck, which is indeed the main deck of a vessel, is called the spar or flush-deck; the portion of this which stretches from the foremast to the stem is called the forecastle. The quarter deck is in the stern.

**Decken**, Karl Klaus von der, kār'l klows fōn dār dēk'kēn, German African traveler:



## DECKER—DECLARATION OF INDEPENDENCE

b. Kotzen, Mark of Brandenburg, 8 Aug. 1833; d. Africa 25 Sept. 1865. He entered the Hanoverian army, which he left after 10 years' service (1860) to follow his bent toward travel. On Barth's advice he went to Zanzibar, and started thence on a journey to Lake Nyassa, which failed through the treachery of his Arab guide. Next year he started on a second and successful journey to the mountain-regions of Kilima-Njaro. In the following year, with Kersten, he climbed that mountain to the height of 13,780 feet. In 1863 he made an extensive voyage along the east coast of Africa, after which he returned to Europe to plan a great expedition for the exploration of east African rivers. This journey ended in disaster, and Decken was murdered by a Somali.

**Decker, Sir Matthew**, English political economist: b. Amsterdam 1679; d. 18 March 1749. He went to London in 1702, and having embarked in commerce, attained the greatest success; was naturalized; received a baronetcy in 1716, and subsequently sat in Parliament. He published anonymously two pamphlets which were much discussed: one (1743) proposed to raise all the public supplies from a tax upon houses; the other, on the decline of Great Britain's foreign trade (1744), contained many good arguments for free trade.

**Decker, Thomas.** See DEKKER, THOMAS.

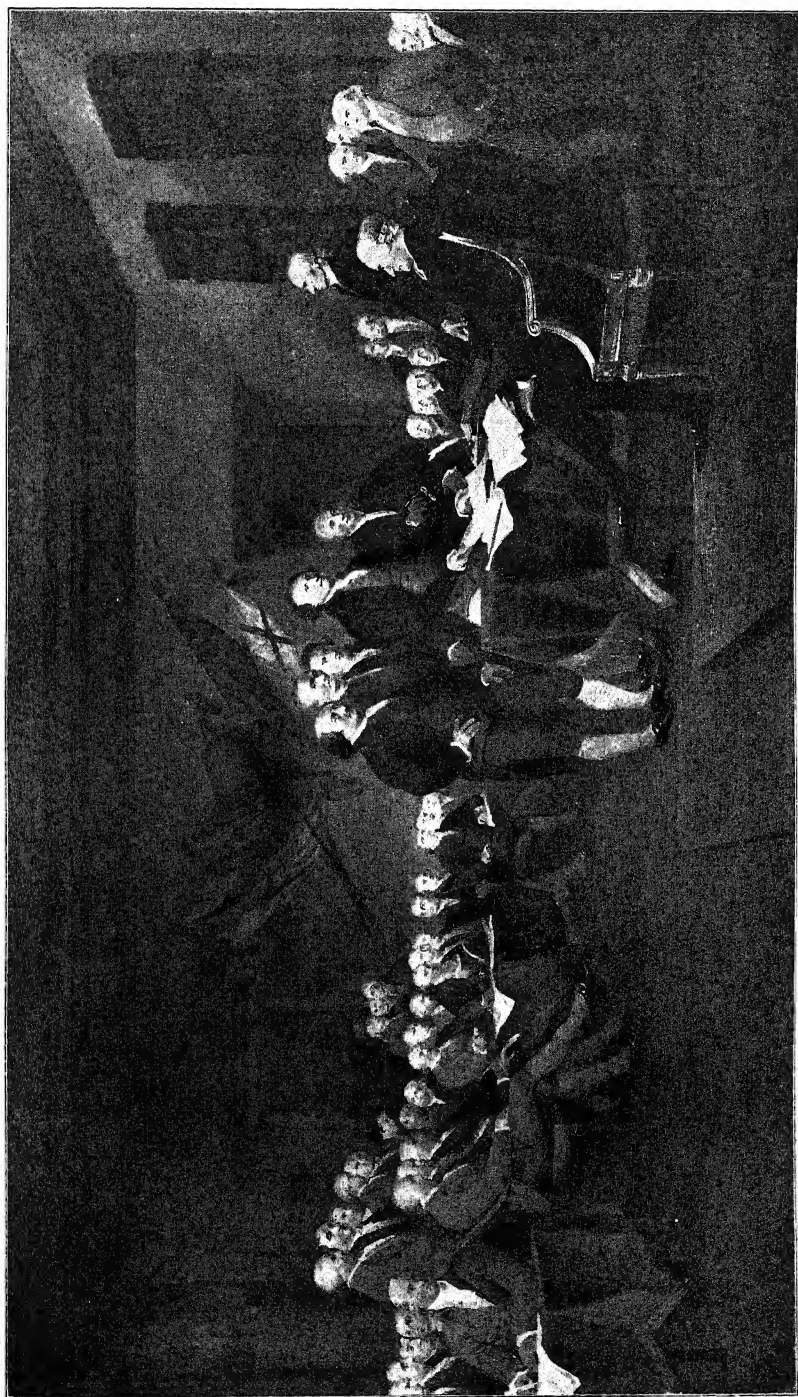
**Declaration.** (1) That part of the process or pleadings in which a statement of the plaintiff's complaint against the defendant is set forth, with the additional circumstances of time and place when and where the injury was committed, where these are requisite. (2) A simple affirmation allowed in certain cases to be taken instead of an oath or solemn affirmation. (See AFFIRMATION; OATH.) In the United States, the form of an oath is immaterial, provided it be such as the witness believes is binding upon his conscience. It is essential that the oath, declaration, or affirmation be administered in a manner prescribed by law. Mere technical variations do not affect the validity of an oath, and verbal deviations are immaterial. Perjury may be committed although the person was improperly sworn. No person will be permitted to make a declaration or affirmation unless he has conscientious scruples against swearing or taking an oath. Declaration in lieu of an oath or affirmation is becoming very general throughout the United States. (3) The statement made by a prisoner, on being arrested on suspicion of a crime, which is taken down in writing.

**Declaration, Dying.** The rule that secondary or hearsay evidence is inadmissible suffers an exception, in law, in the case of a declaration made by a person convinced of his impending death, and who may not survive the trial of the accused. In Scotland, the dying declaration of a witness is admissible even though he is not himself conscious of the danger of death, and in the United States a declaration is frequently admitted, both in civil and in criminal cases, as primary evidence, without regard to the immediate apprehensions of death. The principle under which the dying declaration is admitted is that the awful situation of the dying person is as powerful over his conscience as the obligation of an oath, and does away with all motive to disguise the truth. Accordingly the person against whom a dying declaration is put

in evidence may be allowed to show that the deceased was not of such a character as to feel the religious obligation of his situation. A dying declaration may be adduced for as well as against a person accused of crime; and there are cases on record in which persons charged with murder have been successfully exculpated on this kind of evidence.

**Declaration of Independence, UNITED STATES.** The steps by which the extra-legal *de facto* governments of the colonies during the early Revolution—the committees of correspondence and safety—were turned into formal legislative bodies, are detailed under CONSTITUTIONS, STATE, and CONGRESS, CONTINENTAL. But only a few persons, chiefly in the North, at first contemplated separation from the mother country. That they could have expected to conclude a victorious war by land and sea on any other terms, or to dissolve a successful common government and return to disintegrated nullity, seems so incredible that a certain section of historical scholars set down their professions of loyalty to sheer hypocritical falsehood. The history of sincere attempts at "conciliation" up to and far into the Civil War is sufficient answer to this charge. A still better answer is, that the alleged facts are misstated. The difficulty rises from a failure to notice the synchronism of events and views: opinions changed as circumstances changed. The war began in New England, and there it was readily seen to involve independence; the southern colonies thought the difficulty not beyond accommodation till the war was shifted to their own territory in the spring and summer of 1776, when they promptly came over; and the middle colonies, which the war did not touch till after the Declaration, fought it almost to the last. No coincidences are more striking than that the attack on Fort Moultrie was on 28 June 1776, and the South Carolina delegates changed their votes from no to yes 1 July; and that while the New York delegates refused to vote on the Declaration for lack of authority, it was ratified by a New York convention a week after Howe's arrival at Staten Island, 30 June.

The first Congress, of 1774, assumed neither executive nor legislative authority. The second, early in its existence (6 July 1775), formally disclaimed any purpose of separation. The first half-unconscious step was the appointment, November 1775, of five commissioners to maintain communications with friends of the colonies in "Great Britain, Ireland, or elsewhere": only independent countries send ministers. Thomas Paine's 'Common Sense,' urging independence as inevitable, and the sooner the better, appeared 9 Jan. 1776; it had wide influence, and unlocked many tongues. So general was the concurrence with Paine's views that in fear of them, three of the middle colonies—New Jersey, Pennsylvania, and Maryland—instructed their delegates to vote against any such measure; the other two, New York and Delaware, were bitterly divided, and their delegates took no part in forwarding the independent movement; South Carolina was also hostile, contrary to its usual habit of eager initiative—probably from fear of England stirring up the great Indian confederations against the South, as was afterward done. But events pushed them on. British naval captures led Congress,



FROM THE PAINTING BY TRUMBULL.

SIGNING OF THE DECLARATION OF INDEPENDENCE.



## DECLARATION OF INDEPENDENCE

23 March, to declare all British vessels lawful prize; and on 6 April it opened all United States ports to all vessels other than British. This was an act of absolute sovereignty, acknowledged or not. The colonies, under instructions from Congress, were steadily forming State governments (see CONSTITUTIONS, STATE); and Congress 10 and 15 May recommended all the remaining ones to take the same step, which of course involved making their common Union independent also. John Adams was the foremost agent in all this work. The North Carolina convention 22 April resolved to "concur with those in the other colonies in declaring independence." On 17 May Virginia instructed her delegates in Congress to move a "Declaration of Independence"; and on 7 June Richard Henry Lee made a motion to that effect in Congress, which was seconded by John Adams. On the 8th and 10th this was debated in committee of the whole; but action was postponed to 1 July, as some delegations were averse and others were waiting instructions.

On the 10th a committee of five was appointed to draw up the Declaration: Thomas Jefferson of Virginia, John Adams of Massachusetts, Benjamin Franklin of Pennsylvania, Roger Sherman of Connecticut, and Robert R. Livingston of New York. Its composition was assigned to Jefferson by the committee; the latter and Congress made many changes, but mostly by omission rather than alteration of wording, so that the language is practically all Jefferson's. The chief cancellations were five: (1) and (2) The last two counts of his indictment of the King. (1) That he had "incited treasonable insurrections of our fellow-citizens" by promising them confiscated property. The charge was probably felt to be too weak to maintain, as well as likely to weaken the general case. (2) That he had carried on the slave-trade, and refused to allow American legislatures to suppress it. South Carolina and Georgia, which were actively carrying it on themselves, would not permit this; and too much Northern wealth had been earned by it not to make the North very willing to suppress the passage, which would impress foreign nations unpleasantly as to their sincerity. (3) Superfluous rhetoric about the incredulity of "future ages" as to the daring tyranny of the king. (4) Review of American history, denying that Great Britain had assisted in our establishment, and alleging that "submission to their parliament was no part of our constitution." It was thought best to go as little into the remote origins as possible, fixing the attention upon recent oppressions and natural rights; and above all, to ignore the existence of parliament altogether. That body is not alluded to, except inferentially as the "others" with whom the king has "combined" to subject the colonies to an alien and illegal jurisdiction. This was in pursuance of the steady contention of the colonies. (5) Attacks on the English people for re-electing "the disturbers of our harmony," and allowing their chief magistrate to perpetrate these enormities. This was struck out to avoid giving offense to the friends of the colonies in England, who in fact, by upholding Liberal leaders and even generals, saved us at last.

The Declaration was reported 28 June. On 1 July as fixed, debate was begun afresh on Lee's resolution. New Jersey and Maryland had re-

versed their instructions meantime. In committee of the whole that evening, nine States voted for it; Pennsylvania and South Carolina voted against it (but the latter delegates, possibly after hearing from the South, offered without instructions to vote yes if it would make a unanimous vote), Delaware was divided, and New York, as above stated, refused to vote. The "yea" Delaware delegate, McKean, sent an urgent message to the third, Caesar Rodney, then on a political trip in southern Delaware, to come on at once; Rodney traveled 80 miles the next day, arrived in the evening, and reversed his State's vote. Pennsylvania reversed hers also; and this leaving only the abstaining New York delegates out of the voting, the South Carolina members voted yes. This carried the motion that "these united colonies are and of right ought to be free and independent States, that they are absolved from all allegiance to the British Crown, and that all political connection between them and the state of Great Britain is and ought to be totally dissolved," by 12 yeas and no negative vote. On the 3d the Declaration was taken up, and as amended was passed on the evening of the 4th. The anniversary of the fact of independence is therefore the 2d; that of the adoption of the specific document in which it was proclaimed to the world is the 4th, as celebrated. The usual statement that it was "signed" by the members at this time, however, is incorrect; it was signed by the president and secretary, whose signatures only were borne by the printed copies sent out. The journals of Congress did not enter the Declaration, but left a blank for it, which was afterward filled in and the signatures taken from the engrossed copy. On the 9th the New York convention ratified it, and the delegates gave in their formal adherence on the 15th; it was then, as entitled, "The Unanimous Declaration of the Thirteen United States of America." Six additional Pennsylvania members also recorded a formal vote on the 20th. On 19 July Congress passed a resolution that it should be engrossed on parchment, and on 2 Aug. it was signed by 53 members present; Gerry of Massachusetts, McKean of Delaware, and Thornton of New Hampshire were empowered by their legislatures to sign later, Thornton not signing till 4 Nov.

The parchment with the original signatures was deposited with the Department of State when the government was organized in 1789. In 1823 John Quincy Adams had a copper-plate facsimile made, to give copies to the signers and their heirs; but unfortunately it ruined the original. The wet sheet pressed on the face drew out the ink so that the signatures have become illegible and almost invisible, and the text partially so; and after being shown for many years only on special occasions, in 1894 it was definitely sealed up in a steel case to keep it from light and air. From 1841 to 1877 it was in the Patent Office.

The signers represented the States as follows: New Hampshire: Josiah Bartlett, William Whipple, Matthew Thornton.

Massachusetts: John Hancock, Samuel Adams, Robert Treat Paine, Elbridge Gerry.

Rhode Island: Stephen Hopkins, William Ellery.

Connecticut: Roger Sherman, Samuel Huntington, William Williams, Oliver Wolcott.

## DECLARATION OF INDEPENDENCE

New York: William Floyd, Philip Livingston, Francis Lewis, Lewis Morris.

New Jersey: Richard Stockton, John Witherspoon, Francis Hopkinson, John Hart, Abraham Clark.

Pennsylvania: Robert Morris, Benjamin Rush, Benjamin Franklin, John Morton, George Clymer, James Smith, George Taylor, James Wilson, George Ross.

Delaware: Cæsar Rodney, George Reed, Thomas McKean.

Maryland: Samuel Chase, William Paca, Thomas Stone, Charles Carroll of Carrollton.

Virginia: George Wythe, Richard Henry Lee, Thomas Jefferson, Benjamin Harrison, Thomas Nelson, Jun., Francis Lightfoot Lee, Carter Braxton.

North Carolina: William Hooper, Joseph Hewes, John Penn.

South Carolina: Edward Rutledge, Thomas Heyward, Jun., Thomas Lynch, Jun., Arthur Middleton.

Georgia: Button Gwinnett, Lyman Hall, George Walton.

It may be noted that several of these were not members of Congress when the Declaration was passed.

The Declaration, as agreed to, follows:

### A DECLARATION

BY THE REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED.

When, in the course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume, among the powers of the earth, the separate and equal station to which the laws of nature and of nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal; that they are endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness. That to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed; that, whenever any form of government becomes destructive of these ends, it is the right of the people to alter or to abolish it, and to institute a new government, laying its foundation on such principles, and organizing its powers in such form, as to them shall seem most likely to effect their safety and happiness. Prudence, indeed, will dictate that governments long established should not be changed for light and transient causes; and, accordingly, all experience hath shown, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But, when a long train of abuses and usurpations, pursuing invariably the same object, evinces a design to reduce them under absolute despotism, it is their right, it is their duty, to throw off such government, and to provide new guards for their future security. Such has been the patient sufferance of these colonies, and such is now the necessity which constrains them to alter their former systems of government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having, in direct object, the establishment of an absolute tyranny over these States. To prove this, let facts be submitted to a candid world:

He has refused to assent to laws the most wholesome and necessary for the public good.

He has forbidden his governors to pass laws of immediate and pressing importance, unless suspended in their operation till his assent should be obtained; and, when so suspended, he has utterly neglected to attend to them.

He has refused to pass other laws for the accommodation of large districts of people, unless those people would relinquish the right of representation in the legislature; a right inestimable to them, and formidable to tyrants only.

He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved representative houses repeatedly,

for opposing, with manly firmness, his invasions on the rights of the people.

He has refused, for a long time after such dissolutions, to cause others to be elected; whereby the legislative powers, incapable of annihilation, have returned to the people at large for their exercise; the State remaining, in the meantime, exposed to all the dangers of invasion from without, and convulsions within.

He has endeavored to prevent the population of these States; for that purpose, obstructing the laws for naturalization of foreigners; refusing to pass others to encourage their migration hither, and raising the conditions of new appropriations of lands.

He has obstructed the administration of justice, by refusing his assent to laws for establishing judiciary powers.

He has made judges dependent on his will alone, for the tenure of their offices, and the amount and payment of their salaries.

He has erected a multitude of new offices, and sent hither swarms of officers to harass our people, and eat out their substance.

He has kept among us, in times of peace, standing armies without the consent of our legislatures.

He has affected to render the military independent of, and superior to, the civil power.

He has combined, with others, to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his assent to their acts of pretended legislation:

For quartering large bodies of armed troops among us:

For protecting them by a mock trial from punishment, for any murders which they should commit on the inhabitants of these States:

For cutting off our trade with all parts of the world:

For imposing taxes on us without our consent:

For depriving us, in many cases, of the benefit of trial by jury:

For transporting us beyond seas to be tried for pretended offenses:

For abolishing the free system of English laws in a neighboring province, establishing therein an arbitrary government, and enlarging its boundaries, so as to render it at once an example and fit instrument for introducing the same absolute rule into these colonies:

For taking away our charters, abolishing our most valuable laws, and altering, fundamentally, the powers of our governments:

For suspending our own legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever:

He has abdicated government here, by declaring us out of his protection, and waging war against us.

He has plundered our seas, ravaged our coasts, burnt our towns, and destroyed the lives of our people.

He is, at this time, transporting large armies of foreign mercenaries to complete the works of death, desolation, and tyranny, already begun, with circumstances of cruelty and perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the head of a civilized nation.

He has constrained our fellow-citizens, taken captive on the high seas, to bear arms against their country, to become the executioners of their friends and brethren, or to fall themselves by their hands.

He has excited domestic insurrections amongst us, and has endeavored to bring on the inhabitants of our frontiers, the merciless Indian savages, whose known rule of warfare is an undistinguished destruction of all ages, sexes, and conditions.

In every stage of these oppressions we have petitioned for redress in the most humble terms; our repeated petitions have been answered only by repeated injury. A prince, whose character is thus marked by every act which may define a tyrant, is unfit to be the ruler of a free people.

Nor have we been wanting in attention to our British brethren. We have warned them, from time to time, of attempts made by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them, by the ties of our common kindred, to disavow these usurpations, which would inevitably interrupt our connections and correspondence. They, too, have been deaf to the voice of justice and consanguinity. We must, therefore, acquiesce in the necessity which denounces our separation, and hold them, as we hold the rest of mankind, enemies in war—in peace, friends.

We, therefore, the representatives of the United States of America, in General Congress assembled, appealing to the Supreme Judge of the World for the rectitude of our intentions, do, in the name and by the authority of the good people of these colonies, solemnly publish and declare, That these United Colo-

## DECLARATION OF INDULGENCES — DECLARATION OF PARIS

nies are, and of right ought to be, Free and Independent States; that they are absolved from all allegiance to the British crown, and that all political connection between them and the State of Great Britain is, and ought to be, totally dissolved; and that as free and independent States, they have full power to levy war, conclude peace, contract alliances, establish commerce, and to do all other acts and things which independent States may of right do. And for the support of this declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other, our lives, our fortunes, and our sacred honor.

Howell, 'State Trials'; Burnet, 'History of James II.'; Fox, 'Reign of James II.'

**Declaration of Paris, 1856.** Between the Napoleonic wars and the Crimean war, industrialism in European societies had made great advances over militancy; and the interests of peaceful trade, for the first time in history, were felt even by the most powerful nations to be more important than those of destruction. In

<i>John Hancock</i>	<i>Tras. Hopkinson</i>
<i>Sam<sup>l</sup> Adams</i>	<i>Thos Stone</i>
<i>Rob<sup>t</sup> Treat Paenle</i>	<i>Charles Carroll of Carrollton</i>
<i>John Adams</i>	<i>Th<sup>o</sup> Jefferson</i>
<i>Ellbridge Gerry</i>	<i>Geo Taylor</i>
<i>Josiah Bartlett</i>	<i>Edward Rutledge</i>
<i>Sam<sup>l</sup> Huntington</i>	<i>Joseph Hewes</i>
<i>Step<sup>r</sup> Hopkins</i>	<i>Ja<sup>s</sup> Smith</i>
<i>John Hart</i>	<i>Geo Lyman</i>
<i>Abra Clark</i>	<i>Thos Mearns</i>
<i>Lewis Morris</i>	<i>Bullion Guinness</i>
<i>John Morton</i>	<i>James Wilson</i>
<i>Matthew Thornton</i>	<i>Thos Lynch</i>
<i>Roger Sherman</i>	<i>Samuel Chase</i>
<i>Wm Whipple</i>	<i>George Wythe</i>
<i>Ja<sup>s</sup> Wickham</i>	<i>Benjamin Rides</i>
<i>William Ellery</i>	<i>Lyman Hall</i>
<i>Thos Hooper</i>	<i>Richard Henry Lee</i>
<i>Rob Morris</i>	<i>Arthur Middleton</i>
<i>Claver Wolcott</i>	<i>Thos Nelson</i>
<i>Ben<sup>g</sup> Franklin</i>	<i>Casar Rodney</i>
<i>Wm Paca</i>	<i>Cartor Braxton</i>
	<i>Ben<sup>g</sup> Harrison</i>
	<i>Geo Walton</i>
	<i>Francis Lightfoot Lee</i>
	<i>Thos Heyward Jun<sup>r</sup></i>

**Declaration of Indulgences**, a name applied to the declaration or proclamation issued by Charles II. (1672), and also to a proclamation of James II. (1687), which were virtually acts granting liberty of conscience to all whose rights to their own methods of worship had been curtailed by the Conventicle and Five Mile Acts. These royal acts and declarations of Charles and James suspended the enforcement of the penal status which had been made against the Roman Catholics and Nonconformists, and removed the test of qualification for the holding of civil or ecclesiastical office. James II. ordered the declaration to be read in the churches, 25 April 1688. The primate and six bishops of the Church of England protested against the order, saying it was intended to benefit the Roman Catholics and that it was illegal. The king declared their act seditious libel against the crown, and sent the offenders to the Tower. Later they were tried and acquitted, 30 June 1688. On the day of their release an invitation was sent to William of Orange to come and save England from the Roman Catholics. The signers of this invitation, who wished the downfall of James II., were the Earls of Danby, Devonshire, and Shrewsbury, and the bishop of London and other bishops. (See TEST ACT.) Consult:

opening that war, therefore, the allies — England, France, and Italy — announced their intention to respect the goods of neutrals on the sea as never before; to spare from capture either neutral goods on enemies' ships or enemies' goods on neutral ships, excepting contraband; and not to issue letters of marque for privateering. After the war, at the Congress of Paris, 16 April 1856, the contracting powers publicly declared that the unsettled condition of maritime law bred disputes and conflicts, and that a uniform policy should be established; wherefore they adopted the following "solemn declaration," to bind whoever acceded to it, but exclude either from its obligations or its privileges those who did not: (1) "Privateering is and remains abolished"; (2) "The neutral flag covers enemy's goods, with the exception of contraband of war"; (3) "Neutral goods, with the exception of contraband of war, are not liable to capture under an enemy's flag"; (4) "Blockades, in order to be binding, must be effective — that is to say, maintained by a force sufficient really to prevent access to the coast." This was signed by the delegates from Great Britain, France, Austria, Prussia, Sardinia, Russia, and Turkey; all other civilized maritime nations acceded except Spain, Mexico, most of the South American



## DECLARATION OF RIGHTS — DECLENSION

states, and the United States, which refused on account of their small navies, making a resort to privateering imperative in case of war. This country, however, through its secretary of state, Wm. L. Marcy, offered to accede on condition of what was known as the "Marcy Amendment," to exempt all private property from capture on the seas; privateering would thus become objectless and cease. This was declined, and United States goods remained at the mercy of any two powers at war. On the outbreak of the Civil War, Great Britain and France recognized the Confederacy as a belligerent, and the latter at once issued letters of marque; Mr. Seward for the United States, requested permission to subscribe to the Declaration; but the former powers would only agree on condition of its not invalidating the Confederate rights. Nothing further was ever done about it; but in 1898 the United States and Spain, both outside the Declaration, proclaimed their intention to respect it. Sections 2 to 4 are recognized international law; and as privateers are now replaced by fast cruisers in strong navies, privateering is practically though not formally obsolete.

**Declaration of Rights.** The Stamp Act Congress (q.v.) of 1765 published a "Declaration of Rights and Grievances of the Colonists of America," protesting against the Stamp Act, and any other effort to tax the colonists while denying them representation in the Parliament which imposed the taxes. They sent a petition to the king, and another to Parliament, claiming the same rights as were enjoyed by Englishmen born within the British Isles. The right of representation was included in these; but instead of petitioning for that right, they declared its obvious impossibility a reason why they should not be subject to taxation. The Continental Congress of 1774 (see CONGRESS, CONTINENTAL) asserted a similar claim in its declaration, as a preliminary to calling a final congress, and the Declaration of Independence begins a like assertion. The assertion of such claims was considered so vital in written constitutions by men of that age, that the strongest objection to our national one was its omission in this particular, and the storm of amendments pushed forward (see *Amendments, History of the*, under CONSTITUTION) consisted mainly of bills of rights.

**Declaration of War,** a public proclamation by one government in which it declares itself to be at war with another. The use of the telegraph nowadays and the wide diffusion of news, by which every incident in the events which lead to a war are instantly published, make such a formal declaration scarcely necessary, and each belligerent is usually satisfied with announcing its warlike intentions to its own subjects and to neutrals. In the United States Congress alone has the power to declare war, and when that body votes for war with a foreign power such a measure is considered tantamount to a declaration of war.

**Declar'atory Act,** an act passed by the English Parliament 7 March 1766, accompanying the repeal of the Stamp Act, asserting the constitutional right of the king, with the advice of Parliament, to bind the colonies by its laws and action "in all cases whatsoever." This is English colonial law still; but no attempt has since been made to enforce it against the

wishes of the colonies, except where the rights of British subjects have been infringed.

**Décle, dā-kl, Lionel,** English explorer and author: b. Rocourt, St. Quentin, France, 16 May 1859. He is of French parentage but is a naturalized Englishman. He has traveled extensively in Asia, Africa, and America, was on the staff of the *Pall Mall Gazette* for several years and commanded the *Daily Telegraph* expedition from the Cape to Cairo (1899-1900). He has published: 'Three Years in Savage Africa'; 'Trooper 3809,' an account of his personal experience in the French army.

**Declension,** the change of termination in certain classes of words, in various languages, to indicate the relation in which those words stand toward other words in a sentence. The condition of change to which the words are brought by the several terminations, are styled cases (Lat. *casus*) or fallings, the ancient Latin grammarians representing the nominative as the *casus reclus*, or upright, perpendicular case, while the rest sloped gradually down at various angles, until the ablative was a horizontal line, set at right angles with the nominative. The words subject to declension are of the classes, noun, adjective, pronoun, article. In the Latin language grammarians generally recognize five declensions, five different modes of forming cases, and to each declinable word they assign five cases namely the nominative, genitive (or possessive), dative, accusative (or objective), vocative (or interjectional), and ablative. There is also a locative case, used in the names of cities, and in such forms as *humi*, *domi*. Example, nominative *hortus*, garden; genitive, *horti sepes*, the garden's hedge; dative, *horto additum*, added to the garden; accusative, *hortum colo*, I cultivate the garden; vocative, *o hortie*, O! garden; ablative, *horto disjuncta aedificia*, buildings separated by a garden. This word *hortus* belongs to the second declension: the first declension has the same five cases, for example, *ala* (wing), genitive, *alae*, dative, the same, accusative *alam*, vocative *ala*, ablative, the same save in prosodical quantity, *alā*. An example of the third declension would be *ales* (bird, winged) *alitis*, *aliti*, *alitem*, *ales*, *alite*; of the fourth declension *usus* (use), *usus*, *usui*, *usum*, *usus*, *usu*; of the fifth, *fides* (faith, trust) *fidei*, *fidei*, *fidem*, *fides*, *fide*. The examples show the process of declension in the singular number: for the plural number let one example suffice; the plural cases of *servus* (slave), are *servi*, *servorum*, *servis*, *servos*, *servi*, *servis*: in the plural the nominative and vocative are always of the same form; so, too, are the dative and ablative. The Greek declensions are variously classified, but most generally made three in number and the cases five, as well as two dialectic locative cases. The ancient Sanskrit language has eight cases of nouns and the present language of the Finns has 15: but the languages of western Europe derived from Latin—Italian, Spanish, Portuguese, French, etc.—have dropped the declinational terminations of the Latin, and hence the Latin for "man," which is declined *homo*, *hominis*, *homini*, *hominem*, *homo*, *homine*, has in those modern languages the one form *homme* in French, *uomo* in Italian, *hombre* in Spanish. The ancient Germanic language, from which English is descended, had declensions; but in our language the only remnants of the an-

cient forms are, the possessive case of nouns and the objective case of pronouns, I, me; he, him; she, her; they, them. While in the Indo-European languages above cited, as well as in the Semitic tongues, the unity of the word is not destroyed by inflection, in languages like the Turkish, which are styled agglutinative, elements are added in declension which supersede or obscure the individuality of the original word.

**Declination**, in astronomy, the distance of a heavenly body from the celestial equator (equinoctial), measured on a great circle passing through the pole and also through the body. It is said to be north or south according as the body is north or south of the equator. Great circles passing through the poles, and cutting the equator at right angles, are called circles of declination. Twenty-four circles of declination, dividing the equator into 24 arcs of  $15^\circ$  each, are called hour circles or horary circles.

**Declination, Magnetic.** See MAGNETISM, TERRESTRIAL.

**Declination Needle, or Declinometer.** The magnetic meridian passing through any place on the earth's surface is a vertical plane whose direction is that in which a magnetic needle, free to move about a vertical axis, comes to rest under the influence of the earth's magnetic force. In general, the magnetic and geographical (or astronomical) meridians are not coincident; the angle between is termed the magnetic declination, or (in nautical phraseology) the variation. It is east or west, according as the magnetic is east or west of the geographical meridian. Any apparatus for the measurement of this angle is termed a declinometer, and consists essentially of a means of ascertaining the two necessary elements—namely, the directions, at the place of observation, of the two meridians. Permanently fixed instruments of this nature are set up in all magnetic observatories. They are generally self-registering, and record the slightest hourly, diurnal and annual variations in the declination of the magnetic needle, as well as the more violent changes due to magnetic storms.

**Decline and Fall of the Roman Empire, The**, a monumental work by Edward Gibbon, the first volume of which appeared in 1776, and the last in 1788. 'The Decline and Fall' has been pronounced by many the greatest achievement of human thought and erudition in the department of history. It is a history of the civilized world for 13 centuries, during which paganism was breaking down, and Christianity was superseding it; and so bridges over the chasm between the Old World and the new. It is marked by dignity of style and picturesqueness of narration. The great criticism of the work has always been upon the point of Gibbon's estimate of the nature and influence of Christianity.

**Decoction**, in pharmacy, a solution of a vegetable principle largely obtained by boiling in water the substance containing the principle. Inasmuch as plant drugs usually yield their constituents more readily to hot water than they do to cold water, decoctions are preferred to infusions for obtaining the active principles of plants. Decoctions are not very much used at the present time, because of their great complexity, the active principles of plants being obtained by other means.

**Deco'ic Acid, or Capric Acid**, an organic acid having the formula  $C_{10}H_{20}O_2$ , and occurring in the form of various compounds in butter, cocoanut oil, fusel oil (from certain sources), Limburg cheese, and the fatty matters extracted from the wool of sheep. It is soluble in alcohol and ether, but almost insoluble in cold water. It crystallizes in needles that have a faint odor suggestive of rancid butter, and is prepared by the distillation of oleic acid, or by the oxidation of that acid by nitric acid. The name "capric" has reference to the fancied resemblance of the odor to that of a goat; while "decoic" refers to the 10-carbon atoms that the acid contains.

**Decomposition, Chemical**, is the separation of the constituents of a body from one another, these constituents being obtained either free or in a new state of combination. Limestone, for example, is decomposed into lime and carbonic acid, oxide of mercury into mercury and oxygen, by heat. This is called simple decomposition. Definite organic bodies resemble inorganic in being influenced by similar forces, but the result in their case is somewhat different, arising from their different composition. In the case of an organic body it is possible to convert its constituents at once into their simplest states of combination, but it is also possible to obtain a large number of intermediate compounds by regulating the decomposing action. The process by which such bodies are thus decomposed is styled by chemists compound decomposition.

**De Coninck, Pierre Louis Joseph**, pē-ār loo-ē zhō zēf dē kō-nānk, French genre painter: b. Meteran, Nord, 22 Nov. 1828. He was a pupil of Leon Cogniet, and won the second prize of Rome in 1855, taking medals in 1866 and 1868 and a third class medal in 1873. Among his works are: 'Eva and Uncle Tom' (1857); 'Woman Bathing at Capri' (1863); 'Torture of Queen Brunhaut'; 'Ballet Girl Resting' (1864); 'Christ Blessing Little Children' (1865); 'Two Friends' (1866); 'Lavandara' (1867); 'The Ordeal' (1869); 'Little Charmer' (1870); 'The Ring' (1873); 'Kittens' (1874); 'Pastorella'; 'Hare in Trap' (1881); 'The Trappist.'

**Decorah**, dē-kō'ra, Iowa, city, county-seat of Winneshiek County; situated near the northeastern corner of the State on the Iowa River, about 30 miles from its mouth, and on the Chicago, Milwaukee & St. Paul Railroad. The city has manufactures of paper, flour, and agricultural machinery. The water-plant is owned by the city. A Norwegian Lutheran College and the Breckenridge Institute are located here. Pop. (1900) 3,246.

**Decorated Style**, the second style of pointed (Gothic) architecture, in use in Great Britain from the end of the 13th to the beginning of the 15th century, when it passed into the Perpendicular. It is distinguished from the Early English, from which it was developed, by the more flowing or wavy lines of its tracery, especially of its windows, by the more graceful combinations of its foliage, by the greater richness of the decorations of the capitals of its columns, and of the moldings of its doorways and niches, finials, etc., and generally by a style of ornamentation more profuse and naturalistic, though perhaps somewhat florid. The most dis-

## DECORATION DAY—DECORATION

tinctive ornament of the style is the ball-flower, which is usually inserted in a hollow molding. The Decorated style has been divided into two periods, namely, Early or Geometrical Decorated period, in which geometrical figures are largely introduced in the ornamentation; and the Decorated style proper, in which the peculiar characteristics of the style are exhibited. To this latter period belong some of the finest monuments of British architecture. See ARCHITECTURE.

**Decoration Day**, a legal holiday in all the States except Idaho, for decorating the graves of soldiers killed in the Civil War, whether in national or private cemeteries. The custom of "Memorial Day" (as it is otherwise called) originated with the Southern States, and was copied scatteringly and on different days in some Northern States,—all in the spring, for natural reasons. On 5 May 1868 Gen. John A. Logan, then commander-in-chief of the Grand Army of the Republic, issued an order appointing 30 May of that year for Grand Army services in so decorating graves—choosing that day possibly as being the date of discharge of the last Union volunteer of the War. Since then all the States have adopted it singly, there being no national law on the subject.

**Decoration, Interior, in the United States.** During the last quarter of the 19th century much attention was excited in the Atlantic coast cities by the attempts, which began to be seen and heard of, at rich decoration of houses and churches. There had been, before that time, little of consequence; the plastered adornments of the old colonial houses still existed, and these were sometimes copied, clumsily or otherwise; and there were a few public buildings in which an historical painting or two was put up; but decoration in a larger sense had hardly been undertaken.

Five years after the close of the Civil War some architects in New York and Boston began to try to increase their own charge of the dwelling-house in hand by making careful original designs for interior woodwork, with stairs and fixed sideboards and chimney-pieces, and even in the way of wall-painting of decorative character. All this work could be done from drawings made in the architect's office, always supposing that he had surrounded himself with draughtsmen of good capacity in other than merely mechanical drawing. Thus, excellent wood-carving, in solid oak plank or in delicate panels of holly or mahogany was carried out even to the adornment in a very complete fashion of large staircases and entrance-halls. The painting, too, though limited to scrolls and floriated work, was in the way of considerable artistic development and promised well. The exhibition at Philadelphia in 1876 increased the interest in these with all the other decorative arts, by spreading further West and South the knowledge of their existence and of the possibilities connected with them. The result of this was seen in the establishment of studios, and also of more commercial establishments intended for the making and application of interior decorations of all sorts—from costly mural paintings and brilliant stained glass down to the simplest carved and molded mantelpieces and dadoes. The difference between the two classes of establishments should be made clear, for the establishment

devoted to interior decoration, like that devoted to upholstery and the making of furniture is of necessity commercial in its aims, and will, as a general thing, sell to the buyer what he demands except in so far as the persuasions of the salesman or superintendent can lead him to adopt another view than that which he held originally. The atelier or studio, on the other hand, is the workshop of an artist who, in his capacity as artist, undertakes to give nothing which he does not approve. Although some of the more commercial establishments are directly controlled by able and conscientious artists, the distinction stated above is still to be maintained, and the test is that such a studio as described above will offer nothing for sale, will have nothing that could be sold, will undertake a piece of decoration under the usual limitations and with the usual desire to please the owner of the house, but also limited by the artists' conditions as to what is right.

The establishment of these workshops of different kinds very soon put out of their course the few architects who had desired to undertake such work themselves. When a painter or sculptor would undertake the richer decorations of certain parts of the house, it was natural to leave the less elaborate ones also to him. Only a few of the offices of architects will now undertake decorative work beyond the very simple full-size drawings made for plaster ceilings and molded door-trims. Another influence, also, has appeared—the clever and energetic work done by the larger upholsterers in the great cities, some of whom undertake decoration on a large scale. The student of such things should not lose sight, however, of the essential distinction between work which is done in the commercial way with the single purpose of pleasing the buyer, and that which is done in the artist's way with the primary purpose of being as good as possible within the limits set by the buyer.

The larger and more monumental paintings of which there is so much to be told, began with the decorations by John LaFarge of Trinity Church in Boston, and the paintings by William Morris Hunt in the Capitol, or State House, in Albany, N. Y. These are nearly contemporaneous. Trinity Church having been recently built by H. H. Richardson, LaFarge was set to work in 1876, having several assistants, since well known as decorative painters on their own account. The interior of the church is filled with paintings, chiefly of figure subjects, of which subjects the best known are 'Christ and the Woman of Samaria,' and 'Christ and Nicodemus.' The work of the whole decoration is chiefly a matter of warm color. Mr. Hunt's paintings in the capitol were singularly unfortunate, for, having been painted on the wall directly, they were soon injured by the unequal settlement of the building and then were concealed entirely by the changes which had to be made. They were finished at the beginning of 1879 and in 10 years from that time were lost to sight forever. Their subjects were emblematic and metaphorical in a large way, 'The Flight of Night' and 'The Discoverer.' The purpose of Hunt in painting his decorations directly upon the wall deserves all honor, and it is greatly to be wished that those who have followed him in producing the important mural paintings of America would have followed the same rule. The process of *marouflage*, by which

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the artist paints upon a great canvas which is afterwards pasted upon the wall, has many advantages; but it should certainly be arranged so that the work on this canvas should be done in the room to be adorned by it, and in the light and with the surroundings which are to be its permanent conditions.

The Albany capitol had been put into the hands of an artistic commission consisting of Leopold Eidlitz, H. H. Richardson, and Frederick Law Olmsted. This was done about 1874, and after a short interval of time the work still needing to be done upon the building was divided between the two architects, Mr. Eidlitz taking the north side on Washington Avenue, with the assembly chamber and its accessories, and Mr. Richardson the south side, with the senate chamber. The interior decorations were very different in character each from the other, but each was carried out in a very elaborate fashion without much reference to the original design of the building, which, indeed, was almost entirely changed in character from the third or principal story upward. Richardson's decorations were extended afterwards to include the great staircase at the western end of the building, the elaborate hall and annexed chambers of the Court of Appeals and the State Library. Great originality was shown in these; the wood-work of the galleries, the screens and dwarf partitions, the tribunes and desks for presiding officers and judges, the great chimneypieces and the ceilings were treated with extraordinary vigor and intelligence, and they remain among the most instructive work of independent thinking in design that has been done in America. With the aid of certain sculptors who devoted themselves to this decorative work, among whom should be named John Francis Brines, the elaborate stone-built staircases received an architectural decoration closely akin to that of the porches of entrance: elaborate leafage of the Byzantine type, especially invented and developed for the occasion, was combined with heads (either portraits or ideal portraits) of prominent natives of New York, and ideal heads were introduced in other parts of the work. There was no mural painting done in the capitol other than the pictures by Hunt, mentioned above, nor was there any stained glass used there.

About 1878 John LaFarge contracted with Cornelius Vanderbilt for a carved ceiling in Mr. Vanderbilt's house in New York; the smaller house which was the nucleus of the vast palace that now stands at Fifth Avenue and 57th Street. This ceiling was then carried out in the richest possible way. There was much decoration in relief, ideal figures, and the panels containing them framed and enclosed by molded and carved beams and cross beams so that each panel was treated nearly like a caisson. But the peculiarity of this was that the reliefs were all in polychromy and that very rich materials were used to produce the color effect desired. Glass, in masses (colored and cast for the purpose), bronze (and that of many tones and shades), marble, ivory (sometimes stained), mother-of-pearl and even silver were used in these extraordinary decorations. The same room contained a mantelpiece with a high structure above it of pilasters carrying a special entablature, and all this was inlaid with mother-of-pearl in a very brilliant way. The designs were singularly free from the modern American fault of following

old styles, even to the extent of copying too closely special examples of these styles. It would be impossible to say that any ancient style suggested the treatment adopted.

By 1880 it had become rather common for architects, when employed to build the very costly houses of the new-made millionaires, to recommend to their employers the sculptors and mural painters who could fill these private palaces with decorative art of the highest class. The Villard house in New York, afterward belonging to Whitelaw Reid, was one of the earliest of these, and this contains what are perhaps the finest mural paintings that LaFarge has done: the two lunettes, 'Music' and 'The Dance'; but very soon this was rivalled by houses built in the same city and in Boston and Chicago. George B. Post of New York has been especially successful in obtaining for the finer adornment of his buildings the work of the best men in both the great arts of expression. He was the architect of the Cornelius Vanderbilt house in its former and in its later and much enlarged form, and also of the house of Collis P. Huntington, and had charge of the decorative re-arrangement of the Lawyers' Club in New York and of banking houses in different parts of the country.

There was another singular manifestation of the disposition to adorn buildings of residence, for the great hotels began to find it necessary to pay for costly pictures to adorn their reading and lounging rooms, their dining-rooms and smoking-rooms, and the like. Mr. Hardenberg's hotels showed this tendency among the earliest, for in the Waldorf there is a really splendid ceiling by Will H. Low, representing 'The Triumph of Venus,' and many lunettes and smaller wall-paintings. In the Astoria, adjoining the Waldorf, there are other similar decorations. In the Manhattan there is a long and broad frieze of painting by Charles Y. Turner, representing 'The Triumph of Manhattan,' and in the café a landscape decoration by Frederick Crowninshield, running all around the large room and showing above the high dado of light-colored wood. This last named achievement is a wonderful success in that while the solidity of the wall is not destroyed by the treatment, there is still a far-away look of the Roman campagna with the distant mountains, while in the foreground life-size figures seem to look over the solid wall formed by the wooden dado. Mr. Crowninshield has carried out and enlarged the same style of decoration in his paintings of a certain restaurant at the top of a large department store on 6th Avenue, New York, and this is the most remarkable instance that we can name of the willing acceptance of so elaborate and so purely artistic a decoration in a building devoted to purely commercial purposes.

Decoration other than painting and other than sculpture of human figures has been used in the "office buildings," or great structures built in the business quarters of the cities and rented out in separate rooms or suites of rooms to lawyers, brokers, agents and business men of all sorts, other than the keepers of shops and stores. These buildings since 1875 have been high, fitted with elevators, and solidly built, and since 1885 have been commonly constructed on the "steel cage" principle, which allows of buildings of any height and of rapid construction. This has been the era of the "sky-scrapers,"

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which range from 16 to 24 stories, and require a great number of elevators in proportion to their size. A great deal of elaborate work in the way of marble linings, floors of mosaic, of gray and white and black tesserae, and, unfortunately for safety, highly wrought woodwork in the way of door-trims and window-trims and mantelpieces have been used. There has been some slight attempt to carry out decorative designs in stucco and similar varieties of what may be called in a general sense, plastering. This art has, of course, indefinite possibilities, and there is hope that another generation of artists will see in marble the material for the lining of walls near the foot and where they are most exposed to injuries, while above a certain line the easy method of modelling bas-reliefs in cement or stucco and then painting them in polychromy will be followed.

The Chicago World's Fair, held in 1893, gave much employment to the mural painters and to the sculptors of America during the three or four years preceding its opening. These decorations must not detain us here, because they all vanished with the occasion. It is, in a way, a pitiful thing that the very important paintings of the cupolas and lunettes of those buildings disappeared within a year from the time of their completion.

There are certain public buildings in which it will surprise the student to find very splendid and interesting work, especially in mural painting, where he would certainly look for no such adornment. Thus the Criminal Court-House in Centre Street, New York, has received certain mural paintings by Edward Simmons, ordered and paid for by the Municipal Art Society, and these pictures consist of a central composition of 'Justice,' and two side pictures arranged like a frieze, 'The Fates,' and 'Liberty, Equality and Fraternity.' These pictures are peculiar in being nearly monochromatic, so planned, no doubt, because of the necessity of matching their tones and values with the surrounding white walls—for it was hardly hoped that the whole room could be enriched with color. On the other hand, the building on Madison Square, New York, appropriated to the State Supreme Court, Appellate Division, has its principal rooms and its hall of entrance adorned according to an elaborate general scheme, involving much variety of coloration and many large and fully realized paintings. These are by E. H. Blashfield, Henry Oliver Walker, Kenyon Cox, and many others. This building is also adorned as to its exterior with elaborate sculpture, statues, and high reliefs.

About 1880 was finished the remarkable painting which fills the eastern wall of the Church of the Ascension in New York city. This is the largest mural painting by LaFarge and one of the largest in America. Its subject is that from which the church is named, and the ascending Saviour is accompanied by a glory of angels, while a crowd of disciples watch from the earth below. The value of the picture is in its delicate and melting color, and the fact that this richness of hue and tone has in no way injured the wall as a part of the building. The picture does not count as a break in the solid structure, or as a window through which is seen the external world. The same artist painted in the Church of the Incarnation, the Church of Saint Thomas, and the Church of the Paulist

Fathers, all in New York city. Robert Reid, of New York, has painted in the Church of the Paulist Fathers and in the Church of the Incarnation. At Bowdoin College, in Maine, the elegant little building occupied by the Walker Art Gallery has been decorated by certain paintings, of which those by Vedder and LaFarge are peculiarly important. Some very recent dwelling houses have received splendid mural decorations, among others two at least which have admirable ceilings by Will H. Low. One of these ceilings, in a round drawing-room at a corner of Fifth Avenue, is occupied by a circular picture, of which the subject, put into the title 'Golden Autumn,' is in reality a group of three draped female figures engaged in gleanings from the field and winnowing in the simple old-fashioned way with a sieve.

About 1895 the Congressional Library in Washington was nearly completed, and was then put into the hands of Edward Pearce Casey, of New York, in order that he might administer the elaborate decorations proposed. This building was then adorned with mural paintings by a score of able men, and also by sculptures in the halls and stairs, in this last respect being almost alone in American public buildings. It may be noted here that sculpture has not been employed very freely in interior decoration in America. The great chimney-pieces of hall and library have been adorned with figures, even of life size; and the churches contain many tombs and memorial slabs to which relief sculpture adds a charm, but there is little more. The architect in charge of the Library was fortunately ready to improve his opportunities. The sculptures of Philip Martiny, carried out in a purely decorative way in the lower halls and the great stairs, are singularly appropriate to their place. They include bronze newel statues carrying torches which are fitted with electric lights, and long stretches of parapets very delicately carved with cupids and flowers. The sculptures of the late Olin H. Warner are few, but they are of singular importance, especially a pair of figures in high relief filling the spandrels of the archway leading to the great reading-room—figures of a young and an older student. Herbert Adams furnished a series of figures of about half life size carrying torches. But of all the sculptures of the interior by far the most important are the really surprising statues in the great reading-room, which forms a wide and lofty octagon. Here there are eight colossal symbolic statues worked into the architecture of the room—adorning the abutments of the great vaults—and these are by first-rate men, J. Q. A. Ward, Daniel C. French, Paul W. Bartlett, John Flanagan, and others. On the railing of the high tribunes forming a kind of second story to each recessed side of the octagon are ideal portrait statues of heroic size cast in bronze, and these, though placed too high for the best examination from below, and too distant from him who ascends the high tribune and looks across the rotunda, are still of such remarkable importance that they deserve minute study. Herodotus is by Daniel C. French; Bacon is by John J. Boyle; Patrick Henry is by Herbert Adams; Beethoven is by Theodore Baur; Fulton is by Edw. C. Potter; Shakespeare is by Frederick MacMonnies; Chancellor Kent is by George E. Bissell; Gibbon, the historian, is by Charles H. Niehaus; Michelan-



## DECORATIONS — DECORATIVE PLANTS

gelo is by Paul W. Bartlett. These 16 statues are, then, of singular interest, and casts and photographs of them should be within reach of everyone. The painting of this large building has been carried out with the most elaborate care, and it has been helped by mosaics of ceilings and vaults, as well as of floors. On the ground floor there are long corridors which go off to the north and south, with their ceilings vaulted in cupolas and pendentives; and the entrance hall itself, from which these corridors start, is divided by piers into a northern, a southern, and a western vestibule, each vaulted, with the vaults adorned in mosaic and the lunettes painted by Charles Sprague Pearce and H. O. Walker. Elihu Vedder has a special apartment behind the stair and leading to the great reading-room, a lobby, which he has filled with allegorical paintings of Good Government, Bad Government, Anarchy, etc.; and near this a great wall mosaic, 'Minerva, the Protectress of Civilization.' Edward Simmons has one of the long corridors, in which he has filled 20 lunettes. The eye of the dome which crowns the great rotunda of the reading-room has a broad band carried around it filled with admirable symbolical figures by E. H. Blashfield. It is impossible to continue the examination of this vast collection of mural paintings, for this whole article might be devoted to it. A certain amount of blame has been thrown upon the building for its vividness of color, the constant play and change of contrasting effects; but it is the experience of every student of art who has given time to this strange gallery of art that its worth grows upon the student continually.

The public library of the city of Boston is alone in America in having a great mural painting by Puvis de Chavannes, the chief of modern decorative artists in color. And yet coloration is not the chief object of Puvis, whose work is too severely restrained by architectural considerations — is too honestly and frankly subordinated to the necessities of wall decoration, to be brilliant in color. What was said above about LaFarge's pictures in the Church of the Ascension is to be taken in singular contrast to what is said here about the great painting at the head of the stair in the Boston public library, for here warmth and brilliancy of color are eschewed, and the exquisite result bears out the great Frenchman in his choice of method. There are smaller panels by the same artist on the other walls of the staircase halls. The large room devoted to the giving out of books, in the second story of the library, is painted by Edwin A. Abbey. But here the result has been very different and in no way equally valuable. With the exception of Puvis' picture, the finest thing about the library, and the most important mural painting, probably, in America, is the Sargent at the south end of the hall in the third story, where the great staircase comes to an end. A painting at the north end of the hall was completed about 1895, and this excels in power, in magnificent sweep and force of workmanship, but it cannot compare with the painting at the south end in perfect fitness to the place and to its requirements. That picture at the south end of the room deals with the Christian faith as an established and accepted piece of ecclesiology and is divided into three chief parts, so that the whole wall at the end of the gallery, with no

separation of the lunettes from the square wall below, is filled with the composition, superb in line and in color. The other walls of the same gallery are awaiting their decoration.

Some mural paintings of great importance date from the early years of the 20th century. Edwin H. Blashfield has painted, for the courthouse of Baltimore, a picture 34 feet long and divided into three principal sections, to commemorate the surrender of his commission in the army by George Washington. For the same building Charles Y. Turner painted as a decoration 'The Barter with the Indians for Land in Southern Maryland,' and these two great pictures were completed in the autumn of 1902. Mr. Turner has now in hand another picture for the same courthouse, 'The Burning of the Peggy Stewart at Annapolis in 1774,' this being one of the protests against the tax laws and in all respects equivalent to the famous Tea Party of Boston. For the same building Mr. Blashfield has completed (May 1904) 'The Edict of Toleration of 1649,' Lord Baltimore presenting his people to the personified virtues, Wisdom, Justice, and Mercy. For the Citizens' Bank of Cleveland, Ohio, Mr. Blashfield has completed a painting 27 feet long, symbolical of the uses of wealth. The State Capitol of Minnesota, in the city of Saint Paul, is to contain mural paintings by John LaFarge, Edward Simmons, H. O. Walker, Kenyon Cox, E. H. Blashfield, and Elmer Ellsworth Garnsey. There will also be paintings, framed and hung in the building, by Frank D. Millet and Douglas Volk.

RUSSELL STURGIS,

**Decorations.** See ORDERS AND DECORATIONS.

**Decorative Plants.** The plants used for decoration may be said to include not only species cultivated for purely ornamental purposes, but many others which have important uses. Thus the chestnut-tree, which in the forest is valued for its timber, might in a park have a distinct value for its pleasing form, attractive foliage, and long, graceful catkins. Similarly, the apple-tree when in flower can scarcely be rivaled as a lawn specimen. It is attractive also in its general form and when laden with red or yellow fruit. In the same way the common garden asparagus is a particularly ornamental plant, not only in itself, but to conceal the unsightly stems of such tall-growing plants as hollyhocks, or to act as the background for such brilliant flowering plants as scarlet sage (*Salvia splendens*). Even some of the weeds can be made to do signal decorative duty, as when a large-leaved dock is used to give tone to a group of otherwise characterless foliage, or when a mullin is allowed to rear its flowering stem like an exclamation point in a similar group. Thus it is evident that there is no fast line of demarkation between decorative and useful plants and kation between decorative and useful plants and useless plants, since the purpose for which the specimen is grown determines whether it is decorative or not.

But setting aside such utilitarian cases as forest and fruit trees, shrubs, vegetables, and weeds which may occasionally serve as ornamental subjects, decorative plants may be variously classified as to their place of growth, whether out of doors or under glass; as to their character of growth, whether trees, shrubs, vines, or herbs, etc.; as to their duration.



whether annual, biennial, perennial, etc.; as to their attractive parts, foliage, flowers, fruit, bark, etc.; as to their season of special attractiveness; and in many other ways. For present discussion, however, the place where the plants are utilized and the kind of plants will be considered.

Unquestionably, trees constitute the most important group, since apart from any specially attractive individual feature they form the background or framework of all but the smallest garden pictures. In planting any place of considerable size, trees and their positions are always considered first; the shrubs, which bear a similar relation in small places, the perennial and annual herbs, being considered in the order given. Hence the choice and placing of trees deserves the most careful attention of the planter. Among the species attractive for their foliage and general form are the beeches, birches, lindens, cedars, pines, and spruces; and among those which bear conspicuous flowers are various magnolias, the hardy catalpas, especially *C. speciosa*, which attains a large size and bears large leaves and a profusion of big, white blossoms. The horse-chestnut (*Æsculus hippocastanum*), with its large panicles of white flowers tipped with red, often attains 50 feet in height and is very popular as a lawn and street tree because it casts a dense shade. Other popular flowering species are *Paulownia*, tulip-tree (*Liriodendron*), golden chain (*Laburnum*), and locust (*Robinia*). Of the tender exotic trees which are cultivated only in warmer climates, perhaps few surpass the *Rhodoleia*, a small southeastern Asiatic tree with evergreen leaves and heads of four or five bright pink camellia-like flowers.

Prominently in front of the trees, or upon the margins of ponds in which their beauties may be reflected, the foliaceous and flowering shrubs may be placed in groups or singly. There is a vast list of these, especially of the blossoming kinds, but such as are perfectly hardy in any locality will usually be most satisfactory, since they need less attention as a general rule than specimens that must be coddled. Among the generally admired foliaceous species, the dwarf pines, spruces, and other conifers, willows, maples — especially the Japanese varieties — are perhaps most frequently planted; and among the flowering kinds, the barberry (*Berberis*), dogwoods (*Cornus*), spindle-tree (*Euonymus*), *Deutzia*, *Forsythia*, *Hydrangea*, lilac, *Rhododendron*, and *Spiraea* are general favorites of easy culture. In southern Florida and in parts of California many exotic species have been introduced. One popular shrub is the bottle-brush (*Collestemon*), an Australian evergreen with dense cylindrical spikes of usually red flowers. Some of these tender species are grown in greenhouses in cool climates, as are also various species of *Alloplectus*, tender tropical evergreens with yellowish tubular flowers.

Among the shrubs, partially disclosed and yet seemingly hidden, may be displayed the hardy perennials, such as *Yucca*, with its spire of creamy white blossoms which brighten sombre nooks, or the plume-poppy (*Bocconia cordata*), whose feathery panicles add airiness to rather heavy masses of foliage. Certain hardy perennials are, however, often planted in borders, for which purpose larkspur (*Delphinium*), foxglove (*Digitalis*), *Pentstemon*, sea-holly

(*Eryngium*), peony, and the spiræas are general favorites.

In the South, in California, and in northern greenhouses there is probably no vine so easily grown and so generally satisfactory as the *Bougainvillea*. The flowers are small and insignificant, but the large bract which subtends each blossom is usually bright red or purple. Since the plant quickly covers large areas and is very floriferous, it forms a brilliant covering which continues attractive often for months. It is largely used for training over arbors and piazzas in warm climates. Another popular climber of the same class (tropical) is the crab's-eye vine (*Abrus precatorius*), which grows about 10 feet tall, bears white, pink, or rose-colored flowers, and bright scarlet seeds, each with a black spot. It is often called weather-plant from its supposed powers of indicating the future state of the weather.

Among the host of plants grown under glass, one of the most striking is the gigantic Abyssinian banana (*Musa ensete*) with paddle-shaped leaves often 12 feet long by 3 feet broad, and with leaf stems as thick as a man's fist. Another noticeable though rather insignificant-looking plant is the fragrant olive (*Olea fragrans*) with a profusion of deliciously perfumed tiny cream-colored flowers. Probably the most important group consists of the palms which are so popular as pot and tub plants in decorations at church festivals, social functions, etc., and some of the smaller species of which, especially *Cocos weddelliana*, are largely used in table adornment. There are also many plants, such as *Coleus vriesia*, *Dicffenbachia*, and the ferns which are specially attractive for their odd or graceful foliage. The orchids, such as *Cattleya*, *Lalia*, *Dendrobium*, *Cypripedium*, *Odontoglossum*, and many others are grown for their flowers, their foliage being usually unattractive. Several species of *Euphorbia* are very popular, one, generally known as "poinsettia," being widely used for the whorl of scarlet leaves surrounding the insignificant greenish flowers, while another (*E. splendens*), known as "crown of thorns," is grown more because of its oddity and on account of the legend as to its use in the persecution of Jesus than because of its intrinsic beauty. This legend is also connected with several other spiny plants.

The most important species mentioned above will be found discussed either under their popular or generic names. See also FLORICULTURE; FORESTRY; HORTICULTURE; LANDSCAPE GARDENING.

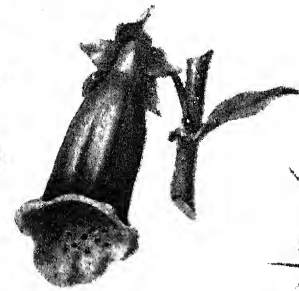
**De Cos'ta, Benjamin Franklin**, American clergyman and writer: b. Charlestown, Mass., 10 July 1831. He entered the ministry of the Episcopal Church and was rector of the Church of St. John the Evangelist in New York 1863-99. In the year last named he became a Roman Catholic. Included in his many publications are: 'The Pre-Columbian Discovery of America by the Northmen' (1869); 'The Moabite Stone' (1870); 'The Rector of Roxburgh,' a novel under the pen-name of WILLIAM HICKLING (1873); 'Verrazano the Explorer' (1880); and 'Whither Goest Thou?' (1902). He became president (1884) of the first branch of the White Cross Society, of which he was the organizer.



DECORATIVE PLANTS.



*Abrus precatorius.*



*Digitalis purpurea*



*Eryngium alpinum.*



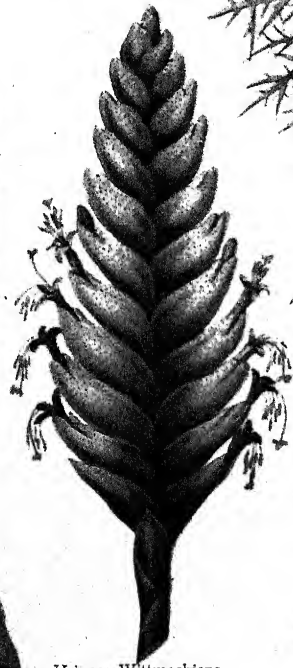
*Aesculus Hippocastanum.*



*Evonymus europaea.*



*Bougainvillea spectabilis.*



*Vriesea Wittmackiana.*



*Callistemon angustifolius.*



*Rhodoleia Championi.*



*Melampyrum nemorosum.*



*Euphorbia splendens.*



*Warszewitzia coccinea.*



*Alloplectus peltatus*



*Salvia sclarea.*



**De Coster, Charles Théodore Henri**, shārl tã-ô-dôr òh-rê dè kôs-tā, Belgian poet: b. Munich 20 Aug. 1827; d. 7 May 1879. His first poetical composition was 'The Owls' Mirror'; then followed 'Flemish Legends' (1856); 'Brabant Stories' (1861), a spirited description of lowly life; 'The Wedding Tour' (1872); and the little comedy 'Jenny' (1865).

**Decourcelle, Pierre**, pē-ār dè-koor-sël, French dramatist: b. Paris 25 Jan. 1856. His first work was the five-act drama 'The Ace of Clubs,' written for Sara Bernhardt, which had an extraordinary success. Then followed a succession of comedies, dramas, comic-opera libretti, and dramatizations of popular novels, written by him individually or in collaboration with other authors; among them: 'The Amazon' (1885); 'Madame Cartridge'; 'The Abbé Constantin' (founded on Halévy's story); 'The Man with the Broken Ear' (after About). He wrote also a sensational novel, 'The Gray Hat' (1887), and 'Fanfan' (1889), both of which were received with great popular favor.

**Decoy**, a place into which wild fowl are decoyed in order to be caught. A decoy pond is kept only in a secluded situation. Several channels or pipes of a curved form, covered with light hooped net-work, lead from the pond in various directions. The wild fowl are enticed to enter the wide mouth of the channel by tamed ducks, also called decoys, trained for the purpose, or by grain scattered on the water. When they are well into the covered channel they are surprised by the decoy-man and his dog, and driven up into the funnel net at the far end, where they are easily caught. There are differences of detail, but the general features of decoys are the same.

**Decree**, in general, an order, edict, or law made by a superior as a rule to govern inferiors. In law it is a judicial decision or determination of a litigated cause. The decree of a court of equity or admiralty answers to the judgment of a court of common law. In ancient history it signified a determination or judgment of the Roman emperor on a suit between parties. In the former German empire the resolutions of the emperor, declared to the estates of the empire, were called decrees. The old name of royal orders in France was *ordonnances* or *lettres*. The national convention, while it possessed sovereign power, used the expression, *La convention nationale décrète*; but the imperial government used the words imperial decree, for instance, in the famous decrees of Berlin and of Milan. In ecclesiastical history the term is especially used with reference to the authoritative decisions of councils. See BERLIN DECREE; MILAN DECREE.

**Decrepitation**, the crackling noise which several salts make when suddenly heated, accompanied by a violent exfoliation of their particles, due to the sudden conversion into steam of the water which is mechanically enclosed between the solid particles of the body; or to the unequal expansion of the laminæ of which the mineral is composed in consequence of their being imperfect conductors of heat. The true cleavage of minerals may be often detected in this way, for they fly asunder at their natural fissures.

**Decretals, The (Decretales)**, (1) the second part of the Canon Law or *Corpus Juris Canonici*

(q.v.). It contains in five books the papal constitutions, laws, and decisions from the time of Gratian's *Decretum*, 1151 to 1234, when this second part was compiled by St. Raymond of Pennafort at the order of Gregory IX. The subject matter of each of the five books is expressed in the mnemonic hexameter verse:

Judicium, iudex, clerus, connubia, crimea;

meaning that the decretals of the first book relate to the constitution of tribunals, those of the second to the duties of judges, those of the third to the rights, privileges, etc., of the clergy, those of the fourth to marriage, and those of the fifth to offenses against the Church's laws.

(2) *The False Decretals*, or the *Pseudo-Isidorian Decretals* are a collection of decretals, gathered ostensibly by Isidorus Mercator, in the middle of the 9th century. The exact date and authorship of the document are not known; but as a canon of the Council of Paris (829) is quoted, the collection must have been made later than the year in which the council was held. Some modern historians claim that the collection was well known before the year 845. Rheims and Mayence are each given as the place where the work of collating and writing was done. The writer called himself Isidore Mercator, and in some MSS. "Peccator." (The writer may have had in mind the great St. Isidore, who had previously made a compilation of decrees and canons.) Historians claim that the name was, like the decretals, false. The collection was received at first as authentic. To have at hand and in convenient form all the decrees of councils and the decretal letters of deceased popes, was indeed a boon to be highly appreciated. It was known that letters and documents existed other than those to be found in any collection, so when this collection made its appearance, it was regarded as worthy of praise and thanks.

The collection opened with the 50 apostolic canons received and collected by Dionysius Exiguus; and these were followed by a number of decretal letters said to have been written by early popes, from Clement of Rome, one of the apostolic fathers, to Melchiades, at the end of the 3d century. None of the letters claimed to have been written by popes are genuine. Decrees purporting to have been promulgated at the councils of Nicæa and Seville, came next. Some of these are true. Then came other letters said to have been written by popes, beginning with Sylvester (who succeeded Melchiades) and ending with Gregory the Great. One letter in this collection, credited to Pope Siricus (384-399), is genuine. The last part of the compilation is a copy of the canons passed by Gregory II. (731) at the council held in Rome. Möhler, the German theologian, in commenting upon the fact that these decretals were at first so well received, almost without a dissenting voice, says: "Pseudo-Isidore seized exactly that in his own age which corresponded to the wishes of all the higher and better order of men. Thence it was that this legislation was so joyfully received. No one suspected anything false, because it contained so much that was weighty and true. If we examine carefully these invented decretals, and try to characterize their composer in accordance with their general import and spirit, we must confess that he was a very learned man, perhaps the most learned man of his time, and at the same time an ex-

tremely intelligent and wise man, who knew his age and its wants as few did. Rightly he perceived that he must exalt the power of the centre—that is, of the Pope—because by that way only was deliverance possible. Nay, if we would pass an unconstrained judgment, we may venture even to call him a great man.”

At the time of the appearance of the collection and for centuries afterward, its contents were so in harmony with the leading thought of Europe that the whole was accepted without thorough examination or criticism. Nicholas of Cusa, an able theologian of the 15th century, was the first one to express a doubt of the genuineness of the collection, and to advance proofs of the truth of his assertion. The Magdeburg Centuriators began investigations, and then many Protestant critics followed the same line of study, arriving at the same conclusion as that of Nicholas of Cusa. Finally, when the Isidore decretals were examined critically by theologians and historians, it was ascertained that nearly all were forgeries, and that anachronisms and blunders existed in large numbers. Phillips, Hefele, Möhler, and others show that in the whole collection there was nothing against the supremacy of the Pope, as had been advanced by some writers; that the letters said to have been written by popes were nearly all false, also that several of the spurious documents existed prior to the 9th century and may have been used in good faith by the compiler.

Consult: Hefele; Paulus Hinschius, ‘Decretales Pseudo-Isidorianæ’; Dumont; Möhler; Phillips; Knust; Rosshirt; Walter; Spittler; Wasserschleber; the brothers Ballerni.

**Decuriones**, magistrates in the provincial *municipia* of the Roman state, corresponding to the senate at Rome. Originally the popular assemblies had the sovereign power in the *municipia*, and conferred the executive authority upon the decuriones. They consisted at first of 10 men, but in later times they frequently numbered more, and sometimes even amounted to 100. Each *curia decurionum* was presided over by two members who were called *duumviri*, and whose powers within their *municipium* resembled those of the Roman consuls during peace. Under the republic the whole administration of the internal affairs of their respective cities was in the hands of the decuriones, but after the establishment of the empire they exercised nearly all the circumscribed rights of the communities, though finally they were little more than receivers of taxes. The decuriones were created by election, and each decurio was required to be at least 25 years old, and to possess a certain annual income. Their election took place on the kalends of March.

**Dedekind, Friedrich**, fräd’rīn dā’dé-kīnt, German poet: b. Neustadt on the Leine 1525; d. 27 Feb. 1598. His principal work is ‘Grobianus’ (1549), a satire in Latin distichs against drunkenness and obscenity; it had wide circulation, and was translated into German, Dutch, and English. He wrote two dramas having a religious polemic end in view: ‘The Christian Knight’; and ‘The Converted Papist.’

**Dedham**, Mass., town, county-seat of Norfolk County; on the Charles River about 25 miles from its mouth, and on the New York, New Haven & Hartford Railroad. The town is one of the oldest in the State, the first settlement

within the town’s limits having been made in 1635. The town is noted as having established the first public school in America supported by a general tax (1644). It has considerable manufacturing interests in cotton, wool, and clay, but its chief interests are connected with Boston, of which it is practically a suburb. Pop. (1900) 7,457. Consult: The town records; Man, ‘Historical Annals of Dedham.’

**Dedlock, Lady**, the wife of Sir Leicester Dedlock, in Dickens’ novel called ‘Bleak House.’ Outwardly cold and haughty, she is inwardly wretched in consequence of being haunted by recollections of her past life, and by fear that the existence of her illegitimate child, Esther Summerson, will be revealed. Lady Dedlock dies at the cemetery where her former lover is buried.

**Deduction** (Lat. *deducere*, to take away, to draw out), in logic, as opposed to induction, is the method of reasoning from generals to particulars, as the latter is from particulars to generals. Induction is the mode by which all the materials of knowledge are brought to the mind and analyzed; deduction, the process by which the knowledge thus acquired is utilized, and by which new and more complicated inductions are rendered possible. Thus every step in a deduction is also an induction.

**Dee, John**, English astrologer: b. London 13 July 1527; d. Mortlake, England, 1608. In early life he had devoted much of his time to mathematical, astronomical, and chemical studies; and in 1548 rumors began to prevail that he was addicted to the black art. They were probably well founded; and to avoid the consequences he went abroad. In 1551 he returned to England and through the instrumentality of Cecil, who presented him to Edward VI., obtained a pension of 100 crowns. The suspicion of the black art appears still to have clung to him, and shortly after Queen Mary’s accession he was charged with practising against the queen’s life by enchantment, and imprisoned. He obtained his liberty in 1555, and after Queen Elizabeth’s accession was consulted by Lord Dudley as to “a propitious day” for the coronation. Lilly’s account of him is that he was the queen’s intelligencer, with a fixed salary; a great investigator of the more secret hermetical learning, a perfect astronomer, a curious astrologer, a serious geometrician, and excellent in all kinds of learning. The nature of his employments excited strong suspicion, and in 1576 he was furiously attacked by a mob, from which he had difficulty in escaping with his life. In 1578, during an illness of the queen, he was sent to consult with the German physicians and philosophers as to her recovery, and after his return was employed to draw up a sketch of the countries which, from having been discovered by English subjects, belonged to the crown. He accordingly prepared two rolls, giving both a geographical description and a historical account of the countries. These curious documents are still extant in the British Museum. After many wanderings, Dee, returning home, obtained from the queen in 1595, the wardenship of Manchester College, which he held nine years. It has been supposed, with some plausibility, that Dee’s character as an alchemist was merely assumed to enable him to act more securely and effectually as a spy in the employment of the English government.



**Dee**, the name of several British rivers. 1. A river in Scotland, partly in Kincardineshire, but chiefly in Aberdeenshire, one of the best salmon rivers in Great Britain. It rises on the southwest border of Aberdeenshire, and flows generally east, 87 miles to the German Ocean. The city of Aberdeen is at its mouth. 2. A river of North Wales and Cheshire; rises in Lake Bala, Merionethshire; flows north-northeast and northwest to the Irish Sea, 20 miles below Chester; length, about 80 miles. 3. A river of Scotland, county of Kirkcudbright, rises in Loch Dee. It flows southeast and south into Kirkcudbright Bay; length, 38 miles.

**Deed**, a written instrument under seal, containing a contract or agreement which has been delivered by the party to be bound and accepted by the obligee or covenantor. It has also been defined as follows: "A writing containing a contract sealed and delivered by the party thereto." (2 Wash. Real Prop. 553.) The law requires greater form and solemnity in the conveyance of land, than in that of chattels. This arises from the greater dignity of the freehold in the eye of the ancient law, and from the light and transitory nature of personal property, which enters much more deeply into commerce, and requires the utmost facility in its incessant circulation.

In the early period of English history the conveyance of land was ordinarily without writing, but it was accompanied with overt acts, equivalent, in point of formality and certainty, to deeds. As knowledge increased, conveyance by writing became more prevalent and ultimately by the statute of frauds and perjuries, of 29 Charles II., Ch. 3, secs. 1, 2, all estates and interests in lands (except leases not exceeding three years) created, granted, or assigned, by livery of seisin only, or by parol, and not in writing, and signed by the party, were declared to have no greater force or effect than estates at will only. And by the fourth section no person could be charged upon any "contract or sale of lands, or any interest in or concerning the same," unless the agreement or some memorandum or note thereof, was in writing, and signed by the party to be charged therewith, or some other person by him lawfully authorized.

With some trivial changes this statute provision has been adopted or assumed as law throughout the United States. Deeds must be upon paper or parchment, must be completely written before delivery, must be between competent parties, and certain classes are excluded from holding lands, and, consequently from being grantees in a deed; must be made without restraint; must relate to suitable property, and should be signed, sealed, and delivered. The consideration of a deed must be good or valuable and not partaking of anything immoral, illegal, or fraudulent.

A deed should be delivered and accepted. A delivery is the transfer of a deed from the grantor to the grantee, or some other person acting in his behalf, in such a manner as to deprive the grantor of the right to recall it at his option. An absolute delivery is one which is complete upon the actual transfer of the instrument from the possession of the grantor. A conditional delivery is one which passes the deed from the possession of the grantor, but is not to be completed by possession in the grantee,

or a third person as his agent, until the happening of a specified event. A deed delivered in this manner is an *escrow*, and such delivery should be always made to a third person. No particular form of procedure is required to effect a delivery. It may be by acts merely, by words merely, or by both combined, but in all cases an intention that it shall be a delivery must exist. It may be made by an agent as well as by the grantee himself. To complete a delivery, an acceptance must take place, which may be presumed from the grantee's possession. In a deed the premises embrace the statement of the parties, the consideration, recitals inserted for explanation, description of the property granted, with the intended exceptions. The *habendum* begins at the words "to have and to hold," and limits and defines the estate which the grantee is to have. The *reddendum*, which is used to reserve something to the grantor; the conditions; the covenants; and the conclusion which mentions the execution date, etc., constitute the formal parts of a deed and properly follow in the order observed here. The construction of deeds is favorable to their validity; the principal includes the incident; punctuation is not regarded; a false description does not harm; the construction is least favorable to the party making the conveyance or reservation; the *habendum* is rejected if repugnant to the rest of the deed. The *lex rei sitæ* governs in the conveyance of lands, both as to the requisites and the forms of conveyances.

Chancellor Kent, after observing that in the United States generally the form of conveyance is very simple, says: "I apprehend that a deed would be perfectly competent, in any part of the United States, to convey the fee if it was to the following effect: 'I, A. B., in consideration of one dollar to me paid by C. D. do grant, bargain and sell to C. D. and his heirs, the lot of land (describe it), witness my hand and seal, etc.'"

**Deeg**, dēg, India, town and dismantled fortress in Rajputana, state of Bhurtpore, 24 miles west of Muttra. It is situated in the midst of marshes, and almost surrounded by water during a great part of the year. At the southwest corner is the lofty rock of the Shah Boorj, on which the citadel stands. Deeg is a place of great antiquity, and contains a remarkably fine palace, only surpassed in beauty by the Taj Mahal of Agra. Holkar was defeated here by the British under Gen. Fraser in November 1804, and the following month the town and fortress were taken. Pop. 16,000.

**Deems**, Charles Force, American clergyman and writer: b. Baltimore, Md., 4 Dec. 1820; d. New York 18 Nov. 1893. From 1866 to his death he was pastor of the Church of the Strangers of New York, and was widely known as editor and author. Included in his publications are: 'Triumph of Peace and Other Poems' (1840); 'The Light of the Nations' (1870); 'Weights and Wings' (1872); 'Chips and Chunks for Every Fireside'; and 'My Septuagint' (1892).

**Deemster**, an officer once attached to the high court of justiciary in Scotland, who formally pronounced the doom or sentence of death on condemned criminals. The office was conjoined with that of executioner. The name is now given in the Isle of Man to two judges who

## DEEMSTER—DEEP RIVER

act as the chief justices of the island, the one presiding over the north, the other over the south division.

**Deemster, The**, a novel by Hall Caine, called by the author the story of the Prodigal Son. It was published in 1877. The scene was laid in the Isle of Man, and opens in the latter part of the 17th century. The Deemster is Thorkell Mylrea, whose nephew Dan, the prodigal, deeply loves his cousin Myra; but her brother Ewan interferes and a duel ensues, resulting in the death of Ewan. Dan is tried and is declared cut off forever from his people, and banished to a remote corner of the island. During a visitation of the plague, Dan takes the place of Father Dalby, the Irish priest, effecting many cures and at last dying of the pestilence. A dramatization of 'The Deemster' was produced by Wilson Barrett under the title 'Ben-Ma-Chree.'

**Deep Bottom, Va., Battles at.** 1. On 25 July 1864, Gen. Grant, then besieging Petersburg, ordered a movement, the principal object of which was to threaten Richmond and draw as many of Lee's troops as possible from the lines in front of Petersburg, so as to give promise of success in assaulting them, upon the springing of a mine prepared by Gen. Burnside. Deep Bottom is opposite a great bend of James River, making a neck of land known as Jones' Neck, at a point where Bailey's Creek flows into the James from the north. Butler's pontoon bridges, one below and one above the mouth of the creek, were held by Gen. R. S. Foster with a brigade of the Tenth corps. The Confederates were entrenched on the west side of the mouth of the creek in Foster's front. About 2 A.M. of the 27th, Hancock began crossing the James by the lower bridge, to turn the Confederate left, while Foster attacked the right. At daylight all moved forward. Gen. Nelson A. Miles' brigade drove the Confederates from their position on the New Market road, east of the creek, and captured a battery of heavy guns, but progress across the creek was barred. From the river to Fussell's Mill, a distance of about two miles, its west bank was held by Kershaw's and Wilcox's divisions, joined during the day by Heth's division. On the morning of the 28th, Kershaw advanced on the Charles City road and drove Sheridan back over a ridge upon which he was posted; but Sheridan, dismounting his men, drove Kershaw back in some confusion, taking 200 prisoners and two colors. Reinforcements arrived until five eighths of Lee's army was now north of the James. Grant wanted no assault made, and on the 29th Hancock and Sheridan recrossed the James. The Union loss in this movement was 334 killed and wounded.

2. Gen. Grant, on 12 August, ordered another movement on the north side of the James to threaten Richmond. Hancock's Second corps, part of the Tenth corps, under Gen. Birney, and Gen. Gregg's division of cavalry, were designated for the purpose. Birney's command was at and near Deep Bottom; the cavalry and artillery went by land, as in July; and Hancock's corps marched to City Point and took steamers for Deep Bottom, 16 miles up the river, where it was landed on the morning of 14 August. Mott's division was to advance on the New Market road and drive the Confederates into their works beyond Bailey's Creek, while Barlow, with

his own division and Gibbons', was to move on Mott's right, and assault the line near Fussell's Mill. Gregg's cavalry was to cover Barlow's right, and when the infantry uncovered the Charles City and Darby roads, was to make a dash on Richmond, if opportunity offered, and if not, to destroy the railroads entering it. Birney was to attack the Confederate right, and, if successful, move up the river roads on Chaffin's Bluff. Field's Confederate division held Bailey's Creek and Wilcox's division was at Chaffin's Bluff. At the first intimation of Hancock's movement Wilcox moved up and joined Field, and from the south side of the James Gen. Lee sent Mahone's division of infantry and the two cavalry divisions of Wade Hampton and W. H. F. Lee. Johnson's and Gary's brigades followed, and there were three regiments from Pickett's division. Mott advanced on the New Market road, but was checked at the creek. It was 4 o'clock before Barlow, on his right could get up one brigade, and with this he assaulted the position near Fussell's, was repulsed, and rested for the night. On the right Gregg had advanced well up the Charles City road, and on the left Birney seized a part of the Confederate line and captured three guns. On the morning of the 15th Birney's corps and a brigade of Mott's division endeavored to turn the Confederate left. Birney moved toward the Charles City road, on which Gregg was advancing, but he made so wide a detour and found so many obstructions, that it was night when he found his proper position, and attack was deferred until morning. As a diversion to his attack Gregg's cavalry, supported by Miles' brigade of infantry, were to move up the Charles City road. Gregg was off at an early hour of the 16th, driving the Confederate cavalry beyond Deep Creek, as far as White's Tavern, only seven miles from Richmond. At 10 A.M. Terry's division of Birney's corps, supported by Craig's brigade of Mott's division, and Birney's brigade of colored troops, advanced against the Confederate line near Fussell's Mill, and, after a severe fight, carried it, taking three colors and between 200 and 300 prisoners from Mahone's and Wilcox's divisions; but the Confederates soon rallied, retook their works, and drove Terry back. Soon after noon the Confederate cavalry, supported by infantry, advanced on Gregg and Miles, slowly driving them back to Deep Creek, and later in the day across it. There was a cessation of hostilities on the 17th. On the 18th the Confederates advanced from their works above Fussell's Mill and attacked Birney, who, with the assistance of Miles, repulsed them. On the night of the 20th the Union troops were withdrawn and returned to their positions in front of Petersburg and at Bermuda Hundred. In this battle the Union troops numbered about 28,000, the Confederates about 20,000. The Union loss was 2,161 killed and wounded, and 625 missing. There are no returns of Confederate losses. Consult: 'Official Records,' Vol. XLII.; Humphreys, 'Virginia Campaign of 1864-5'; Grant, 'Personal Memoirs,' Vol. II.; Sheridan, 'Personal Memoirs,' Vol. I.; Walker, 'History of the Second Army Corps.'

E. A. CARMAN.

**Deep River** rises in Guilford County, N. C. Its general direction is southeast to Chatham County, where it unites with the Haw River and forms the Cane Fear River. Its

## DEEP-SEA EXPLORATION

length is about 125 miles; it has good water power, some of which is utilized at Lockville.

**Deep-sea Exploration.** The exploration of ocean depths dates from 1867, when Pourtales and Mitchell, officers of the United States Coast Survey, engaged in systematic sounding and dredging in the Straits of Florida. From 1868 to 1872 a similar work was undertaken by Wyville Thomson, carpenter, and George Jeffries, in British vessels, sounding the Mediterranean and North Atlantic. Beginning in December 1872, and continuing until the spring of 1876, the *Challenger*, a British ship, under Nares and Thomson, made a tour of the world, taking soundings and dredging from 362 stations. France and Norway sent out expeditions for a like purpose at a later date. The Prince of Monaco also took great interest and did much sounding from his yacht, bringing up fish from a depth of two miles. Excepting the successful and complete work of the *Challenger*, most of the exploration valuable to science has been done by the United States, the *Bibb* making a tour in 1868-9, and the *Blake* doing continuous duty in this field from 1877 to 1880, under the co-operation of Agassiz, Sigsbee, and Bartlett, while the United States fish commission vessels, *Albatross* and *Fishhawk*, engaged in lengthy exploration under Baird, Belknap, Tanner, etc.

The average depth of the ocean is now known to be about  $2\frac{1}{2}$  statute miles. Its floor has a contour very similar to that of the land, there being vast levels or plains, ravines, gorges, ridges and mountains that rise into islands, and deeps that fall farther below the sea-level than the topmost peaks of the Himalayas rise above that level. Light penetrates about 100 fathoms, or in specially clear water, under the direct rays of a tropical sun, to perhaps nearly 200 fathoms, and below it is all dark, except for the phosphorescence of some of the deep-sea inhabitants. The depths are also cold, approaching the freezing point in all latitudes. The cold waters from the frozen poles flow in slow currents along the bottom, over the dead marine organisms that strew the greater portion of the ocean floors, down to the deepest regions, where the bottom is of red clay of Tertiary formation.

The 100-fathom depth to which light penetrates has been termed the littoral region, and within this grow marine algae, and the animals that feed upon them. The depths below 1,000 fathoms have been termed the benthal area, while the area between 100 and 1,000 fathoms has been termed the abyssal area. The slopes along the edges of the continents, extending roughly 200 miles from land, constitute the region of terrigenous deposits, the sea bottom being composed more or less of the washings carried down by the great rivers that drain the continents. Besides the washings, which partake of the nature of the adjoining land, this region contains green coral, and volcanic mud. Beyond the influence of the shore washings comes the region of pelagic deposits, the ocean floor being strewn with dead marine organisms that have sunk from the littoral region.

The immense pressures of the great deeps below 3,000 or 4,000 fathoms are probably accountable for the fact that the dead organisms (so common to higher regions) are not found, but apparently dissolve and float away in the currents. The deepest holes have a bottom of

red clay that appears to have undergone no material change since the Tertiary Period.

Since there are no algae below the littoral region, it follows that all the marine animals below are carnivorous. None of these are ever brought up alive, since, if alive when netted, they succumb to the expansion that results from their being brought up to the surface where the pressure is so much below what they are constructed to reside in. The sea pressures are enormous, increasing from 15 pounds per square inch at the surface to a ton per square inch at a depth of 1,000 fathoms. The fish brought up from a depth of 3,000 fathoms are therefore subject to a surrounding pressure of three tons per inch of surface, a pressure that would be dangerous to a high-grade steel boiler. The deep-sea fishes do not succumb to it, because their tissues are porous, and the fluids of their bodies are of a like pressure with their surroundings. This maintains a balance that subjects them to no more strain than would a solid shot receive by being immersed at the same pressure. The bones of these fishes, instead of being built heavy to withstand a crushing pressure, are made fibrous and full of porosities, and include scarcely any calcareous matter. When these fish are brought to the surface their joints and muscles are found to be very loosely connected, and they have to be handled very carefully. Some of them are sure to break up with the least handling, as the *Plagiodus* of the Madeiran Sea. The deep-sea fishes universally are provided with air-bladders, and these of course tend to expand as the fish are brought up. Probably they could be brought up alive, if the speed of raising them were very slow. There are many deep-sea fishes that live at or near the surface when quite young, and go deeper as they advance in age. Nearly all the deep-sea fishes are classified among the same families as the fishes familiar on the surface, but the *Alepocephalida* and *Halosaurida* are found only in the depths.

At a depth of 400 fathoms the *Gobiida*, *Blenniida*, *Percida*, *Scorpenida*, *Trichiurida*, *Coltoidea*, *Cataphracti*, *Bathylthyrissida*, and most of the *Trachinida* cease to exist. At a depth of 500 fathoms the sharks, rays, and flatfish are no longer found. At a depth of 700 fathoms the *Cottoidea*, *Discoboli*, *Zoarcida*, etc., disappear. The limit of the *Holocephali* is about 1,200 fathoms. The families commonly found at the greatest depths, 2,500 fathoms and under, are the *Berycida*, *Ophidiida*, *Pediculati*, *Macrurida*, *Sternoptychida*, *Scopelida*, *Stomatida*, and *Muraenida*.

Both the number and variety of fish decrease as depths increase, as the vast body of marine animals prefer to live near the surface.

The phosphorescent fishes are mostly characterized by luminous organs, which present all sorts of modifications as to location, appearance, and structure. Some of them are luminous all over when in motion and non-luminous when at rest, the brightness being occasioned by a luminous secretion emitted when the creature is active. Some of the deep-sea creatures are blind, others see by phosphorescent light, which they or other organisms emit. The fishes in the very great depths have small eyes, while those of moderate depths have large optical organs. Many deep-sea animals have highly developed feelers; the coloration of others is extremely

## DEEP-SEA LIFE

brilliant, yellows, reds, greens, and purples being dominant colors, while there is a strange absence of blue. The fishes are mostly dark-colored, while the crustaceans, holothurians and starfish are the most brilliant, the colors being often in large patches of striking contrast. No deep-sea fishes above about five feet in length have been taken. This is not regarded as evidence that they do not grow longer, the fact that the mouths of the largest beam-trawls in use are only about 11 by 2 or 3 feet probably having something to do with the matter.

The dredge or beam-trawl commonly used is a form of big bag-net, of 20 to 25 feet in length, that is weighted and dragged along the bottom. As many as 800 fishes have been brought up in a single haul with such a dredge, from a depth of 1,770 fathoms, in Bering Sea. Four or five hours are required to dredge at such a depth. The deepest haul on record at which animal life was obtained was made by the Albatross of the United States Fish Commission, near the Tonga Islands, the depth being 4,173 fathoms. Ten hours elapsed from the time the dredge went overboard till it was brought again to the deck.

The tangle is a device used for bringing up specimens of fauna or anything it can catch. This consists of an iron bent in the form of an inverted V and having frayed rope attached to it. During recent years gill-nets have been used at a depth of a mile, and traps and trawl-lines have also been sunk to considerable depths.

The first reliable sounding at a great depth is credited to Capt. Sir James Clark Ross, who in 1840 sounded 2,677 fathoms on the west coast of Africa. Subsequent soundings were reported as deep as 7,000 fathoms, but as these were made with the old-fashioned clumsy apparatus that tended to drift tremendously, and as they do not agree with modern soundings, they are not credited. In 1854 J. M. Brooke of the United States navy, suggested the employment of a dropped weight in deep-sea sounding, and this was found to assist matters so much that it has remained in use ever since. The first attempts to substitute wire for rope were not very satisfactory, owing to the too great thickness and weight of the wire used. When steel piano-wire of great tensile strength was brought into use and weighted with a 60-pound shot, arranged to be dropped, it was found that the soundings were made with a close approach to accuracy, and at much greater speed in much less time than before.

In 1872 there was invented the cylinder sounding machine in which a cannon-ball was used for the sinker, the ball having a hole bored through it, in which was placed a metal tube or small cylinder. When the weight descended into the muddy bottom, the tube was filled with mud, and a device closed it, at the same time releasing the ball. Another device originated later consists of two hemispherical cups, normally hinged so as to be apart. When the weight strikes the bottom it brings the cups together, so that they grasp whatever is in the way. The wire used in soundings weighs about 14 pounds to the mile, and very ingenious reeling-machines have been devised for handling it. The first difficulty to be overcome was the roll of the ship, which tended to jerk the line. This is compensated for, and a friction device is adjustable so as to balance the weight of wire, etc.,

that is out. Elastic appliances, called accumulators, were devised by C. D. Sigsbee of the United States navy, and these have made it possible to employ steam power in paying out and reeling in the line.

The testing of deep-sea currents is done with the current-meter, the accepted form of which is hung on a wheeled traveler from the line sent down. A screw-propeller-like device rotates with the current, and there is a contrivance for registering the number of revolutions, from which registration the speed can be computed. The older devices, which were less satisfactory, depended upon the differential motion of surface floats to note the difference between upper and lower currents.

When it was first endeavored to take temperatures by thermometers at considerable depths it was found that the results were erroneous, apparently because of the increased pressure. Miller and Cassella invented a double thermometer that partially overcame the difficulty, but it served to register only the maximum and minimum temperatures. Negretti and Zambra improved on this, arranging the thermometer in reversed position while descending, and bringing it back to proper position at the depth of the test. The turn resulted in separating the column of mercury above the bulb, and the correct temperature could be indicated.

A most ingenious apparatus for reading the temperature of a descending sounding apparatus from the deck of a vessel has been designed by Sir William Siemens. He secures the temperature on the Wheatstone bridge principle, by the electric resistance of a conductor. A copper vessel of water is heated or cooled until the bridge balances, and the temperature of the water in the vessel is then the same as that below. The apparatus is unfortunately too delicate for ordinary use. All instruments sent down into the depths have to be protected against the pressure, their strength being proportioned to the depths to which they are to be used.

The deepest sounding made up to 1876 was that of the *Tuscarora*, of the United States Fish Commission, which reached 4,655 fathoms off the coast of Japan, in 1874. The *Challenger's* deepest sounding was also in Japanese waters, near the Admiralty Islands, the depth being 4,575 fathoms. In 1896 the British ship *Penguin* got 5,155 fathoms north of New Zealand, breaking the record. This was the deepest found until 1900, when the United States cable survey ship *Nero* found a depth of 5,269 fathoms near Guam. Other deep soundings are those of the *Albatross* of the United States Fish Commission, which located a depth of 4,813 in the western Pacific, and of the *Blake* of the United States Coast Survey, which sounded 4,561 fathoms off Porto Rico, this being the deepest yet recorded in the Atlantic Ocean. No deep places have been found north of the 55th degree of latitude, which tends to confirm the theory of some that the Arctic Ocean is shallow. Consult: Agassiz, 'Three Cruises of the *Blake*'; Sigsbee, 'Deep-Sea Sounding and Dredging'; Tanner, 'Deep-Sea Exploration.'

CHARLES H. COCHRANE.

**Deep-sea Life.** It is difficult to draw the line between deep-sea life and that of shallow water, owing to the various depths in which certain species live. Thus the common shore-crab





# DEEP-SEA LIFE.



1. Pheronema Carpenteri. 2. Hyalonema Sieboldii. 3. Semperella Schultzzi. 4. Dactylocalyx pumiceus. 5. Sclerothamnus Clausii. 6. Chondrocladia virgata. 7. Actinotheca pellucida. 8. Pectanthus asteroides. 9. Drymonema Victoria. 10. Ypsilothuria attenuata. 11. Rhopalodina Heurteli. 12. Oneirophanta mutabilis. 13. Euphronides Talismani. 14. Peniagone rosea. 15. Psychropotes buglossa. 16. Styracaster spinosus. 17. Hymenaster rex. 18. Arcturus Baffini. 19. Nematocarcinus gracilipes. 20. Colossendeis Titan. 21. Nymphon robustum. 22. Boltenia pedunculata. 23. Eustomias obscurus. 24. Eurypharynx pelecانoides. 25. Halosaurus macrochir. 26. Neostoma bathyphilum. 27. Macrurus globiceps. 28. Melanocetus Johnstoni. 29. Stomias boa.





## DEEP-SEA LIFE

of New England (*Cancer irroratus*) ranges to a depth of nearly 500 fathoms. The Challenger Expedition selected as defining the deep-sea fauna, a depth of 100 fathoms, others have taken 500 fathoms as marking its upper boundary, and still others a depth of 1,000 fathoms. A knowledge of this life is only obtainable by means of apparatus which will bring to the surface specimens from these great depths. The chief of these instruments, aside from the sounding lead which is very inadequate for this purpose, are dredges, tangles, and trawls, of which various patterns have been devised but which may be described in general terms as follows: The dredge consists of a rectangular frame-work of iron, one edge being sharpened or fitted with rake-like teeth to plow or scrape the bottom, while a net or bag fastened to the frame serves to hold the material collected and to bring it to the surface. This is best adapted for obtaining forms which live, attached to, or burrowing in, the ocean bottom. The trawl is a similar net so arranged as to be drawn just above the bottom and is valuable for collecting fishes which swim freely through the water. The tangle consists of large masses of unraveled rope, usually attached to a chain, which, sweeping over the ocean floor, entangles spiny forms like shrimps, starfish, sea urchins, as well as forms like hydroids and sea anemones, with numerous tentacles. Somewhat different is the Tanner net. This is so arranged that it can be sent down close to any desired depth, opened there, drawn through the water and then closed again before being drawn to the surface. By means of this the fauna of any desired depth can be collected without danger of admixture with forms from other depths. Details of the construction of these and many other pieces of collecting apparatus may be found in Agassiz, 'Three Cruises of the Blake'; Sigsbee, 'Deep-Sea Sounding and Dredging' (U. S. Coast Survey, 1880), and in the publications of the United States Fish Commission.

Although the dredge had previously been in use in the oyster and scallop fisheries it was first employed for scientific purposes (in moderate depths) by the Danish naturalist, Otto Fabricius Müller, 1750. (In America it was first used by Henry Wheatland of Salem, Mass.) Owing to faulty observations and to a belief that life could not exist in the greater depths of the ocean on account of the great pressure and the absence of light it was long thought that animals were not to be found at depths greater than 500 fathoms. This view disregarded the fact that Ross and Sabine, 1829, claimed to have obtained living animals from a depth of about 2,000 fathoms in Baffin Bay. Little by little evidence from sounding lines and submarine cables was accumulated which tended to overthrow this belief, but its complete disproval was accomplished by the dredgings of the United States Coast Survey in the Strait of Florida, 1867, when animals were found to be abundant at a depth of 700 fathoms. This was followed, 1869, by the expedition of the English ship Porcupine, which made successful casts of the dredge in 2,435 fathoms of water. Since that time numerous deep-sea dredgings have been conducted by the various governments, the most noticeable being the cruises of the English ship Challenger, the American Blake and Albatross, the French

Travailleur and Talisman, the Russian Minineh, the Swedish Vanadis, the Dutch Barents Expedition, the German Tiefsee Expedition, and the explorations of the Prince of Monaco. The results of all these go to show that life, even of highly organized types, occurs in the greatest depths of the ocean.

Since the dredge, tangles and trawls can touch but a minute portion of the deeper parts of the ocean bottom we have, as yet, but an inadequate knowledge of the benthic or abyssal fauna for details of which the reader should consult the reports of the various expeditions previously mentioned. In general the following remarks may be made. The greater the depth, the fewer the species present. Thus in the collections of the Challenger, 2,050 species were taken in depths between 100 and 500 fathoms; 710 between 500 and 1,000; 600 between 1,000 and 1,500; 500 between 1,500 and 2,000 fathoms; 340 between 2,000 and 2,500, and 235 from depths greater than 2,500 fathoms. Again the results of the same expedition show that the number of individuals also decreases with the depth. In depths of over 1,000 fathoms the dredge rarely captured over 10 or 15 specimens of any one species, while in lesser depths hundreds of a kind are common.

The majority of the abyssal forms probably live on the surface ooze of the bottom and the minute organisms occurring in it, while these forms are in turn preyed upon by larger rapacious forms. A prominent feature of these is the frequent occurrence of phosphorescent organs which probably serve as a lure. Some are blind, some are provided with very large eyes, and it seems certain that all the light in the greater depths of the sea is produced by the phosphorescent organs. Another feature is the large size of some of the individuals. Thus while the shallow water species of the hydroid *Monocaulus* reach a length of but two or three inches, the deep-sea form is three feet long. It was hoped that the deep-sea fauna would reveal living representatives of extinct groups, but this hope was not realized, nothing having been found older than the horse-shoe crab (*Limulus*) the brachiopods, *Ceratodus*, the Port Jackson sharks and the Dipnoi of shallower or fresh waters.

Taking now the separate groups of living forms occurring in the deeper waters the following general remarks may be made: Plants are extremely rare and include only a few minute and inconspicuous forms. Even the lower *Algæ* (seaweeds) so common in shallower waters are lacking. Among the sponges the so-called glass sponges (*Hexactinellidæ*) are most abundant, some of the species being enormous (3 or 4 feet in diameter). The *Calenterata* are represented by the giant *Monocaulus*, already mentioned, and by a few jellyfish and corals. All groups of Echinoderms occur, most noticeable being the comparatively large number of crinoids and of holothurians, many of which are strange in structure and bizarre in outline. The *Arthropoda* consists largely of prawns, schizopods and isopods, some of the latter being gigantic in size, and the strange sea spiders (*Pycnogonids*), some having slender legs extending a foot or more from the body. Crabs are rare, as are also annelids and molluscs, while a few brachiopods (and these not of the oldest types) occur. Possibly the most interest-

## DEER—DEER-MOUSE

ing are the fishes. Many of these are noticeable for their strange shapes, and especially for the long and slender teeth and the distensible stomachs. Thus the *Chiasmodon niger*, the black swallower, has been taken with a fish, actually larger than itself, coiled up in its stomach. On the other hand, *Eurypharynx* and *Gastrosomus*, the pelican fishes, are eel-like forms with enormous mouths and with a trunk not as long as the lower jaw. These lack teeth and are supposed to live not upon other fishes but upon minute forms which they collect in their enormous scoop net. *Ipnops* lacks eyes but has nearly the whole top of the head converted into a pair of phosphorescent organs, while in the *Ceratiida* the head frequently bears tentacles with phosphorescent organs at their tips. The ribbon fishes (*Regalecus*), which are occasionally found floating, exhausted or dead, at the surface of all the seas, are presumably deep-sea forms, although none have been drawn up in the trawl. As the common name indicates they are band-like in appearance, and since specimens have been taken measuring over 24 feet long it is possible that these or larger specimens may form part of the basis of sea-serpent stories. A noticeable feature of all the deep-sea forms is the prevalence of red and brown colors. Many of the fishes when brought to the surface have the viscera forced out through the mouth by the expansion of the air in the swim bladder.

Two factors render life possible in the greater depths of the sea. The constant currents descending from the surface in the polar regions to the bottom and thence to the equatorial regions bring with them the necessary oxygen, although the amount of this gas present in the greatest depths is much less than at the surface. The other factor, that of food, is, in the last analysis, furnished by the constant death of surface (pelagic) forms, whose dead bodies, slowly sinking through the water, furnish the nourishment needed by the simple abyssal animals, which in turn are preyed upon by those more highly organized. The literature of deep-sea life is enormous. The student should consult the reports of the various expeditions mentioned above, especially those of the Challenger expedition. Many papers will be found in the publications of the U. S. National Museum and the U. S. Fish Commission, while general summaries are afforded by Agassiz's, 'Three Cruises of the Blake'; Moseley's 'Notes of a Naturalist' and Sir Wyville Thompson's 'Voyage of the Challenger.'

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**Deer**, animals of the family *Cervidae* (q.v.), which are noted for their grace of structure and their fleetness of motion. Since the earliest times they have been known as objects of the chase, and their meat, "venison," is considered a delicacy. They were especially renowned in Greece; and we find many references to them in Scripture. The male deer is usually called a "stag," or when mature a "hart." The female is called a "hind," or "doe." The term doe, however, is applied also to females of the antelope family.

The deer is valued not only as food, but for commercial purposes. The skins make a peculiarly strong, soft leather, known to trade as

buckskin; this is valuable for shoes, saddles, etc. The skins with the fur on are sometimes used for tent-covering, and also make excellent rugs. The hoofs and horns are prized for ornamental purposes, especially the antlers of the roe-deer, which are utilized for making umbrella-handles, and for similar purposes; and the elk-horn, often employed in making knife-handles. The Chinese also make a medicine from stag-horn and they eat the antlers of certain species when "in the velvet."

The reindeer is, commercially considered, as valuable to the frozen north as the camel is to the desert traveler. Its fleetness and surefootedness, as well as its strength and power of endurance, render it invaluable to man in the far North. Consult: Lydekker, 'Deer of All Lands' (London 1898); Roosevelt (and others), 'The Deer Family' (New York 1902). See *CERVIDÆ*, the names of various genera, and English names, as Elk, Moose, etc.

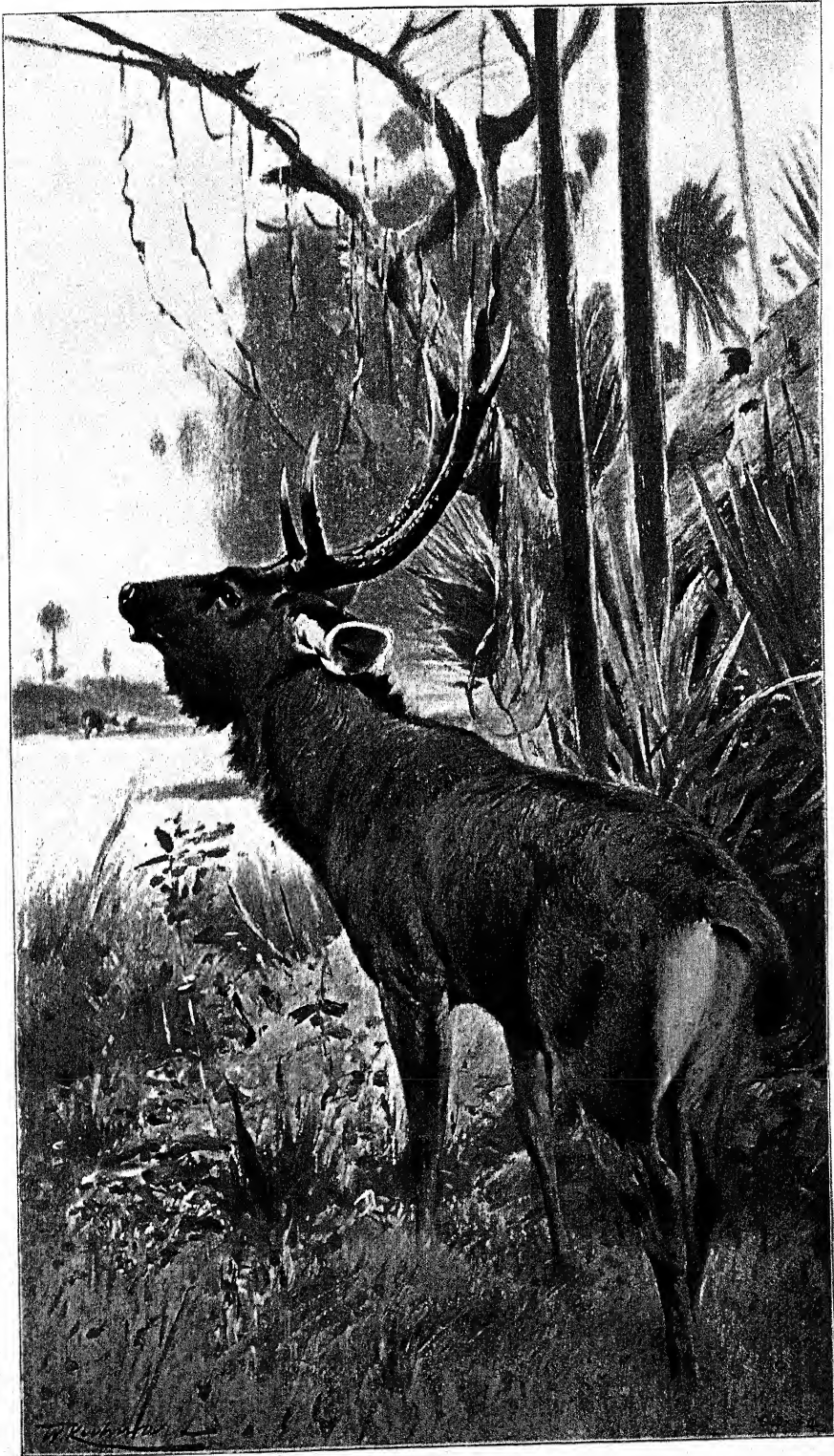
**Deer Forests**, large tracts of waste or uncultivated and mostly uncultivable land, chiefly situated in the Highlands of Scotland, set apart as grounds in which the stag or red-deer is hunted for sport, but is otherwise protected and allowed to roam in its natural wild state. The name forest does not in this case imply the existence of trees. As a matter of fact most deer forests are mountains or high-lying stretches of ground, exhibiting large areas covered with heath, in many places peat-bogs, marshes, lochs, or bare rock, elsewhere patches of grass or other herbage, while plantations of trees of greater or less extent may also occur. Some of the deer forests are of very great extent, the larger covering, say, from 50,000 to 70,000 acres. The counties in which they are chiefly situated are Sutherland, Ross and Cromarty, Inverness, and Argyre, while they also exist in Aberdeen, Banff, Forfar, Perth, and Caithness. A number of them are retained in the hands of their proprietors, while many others are let, either for the shooting season or for a period of years, and in this case may bring a large rental to their owners. The annual letting value of the larger deer forests may run from £1,000 to £4,000 or even more, and the total rental of the deer forests of Scotland has been set down at over £200,000 per annum. Every stag killed costs the person who rents the ground about 50 guineas. For a deer forest is always an expensive affair, not only for the rent that has to be paid, but also for the number of keepers, gillies, watchers, beaters, etc., that have to be employed in connection with it.

**Deer-grass** (*Rhexia virginica*), the American representative of the Asiatic family of plants called *Melastomaceæ*, meadow-beauty family, of which only 10 species are found in the United States. The deer-grass extends from Maine to Florida, and west to Illinois, Missouri, and Louisiana. Other species extend the habitat of the genus to Texas. The flowers are conspicuous and showy, with bright rosy purple petals, and render the meadows unusually gay when adorned with patches of this lovely plant, entitling it to the common name of the meadow-beauty.

**Deer-mouse**, the common white-footed mouse of North America, a rodent of the family *Muridæ*, genus *Hesperomys*. The main color of its body is buff or fawn, growing dark along







SAMBUR (*Cervus Unicolor*).





## DEER-STALKING — DEFAUX

the back, the feet and under parts being snowy white. With full, bright eyes, high, rounded ears, long whiskers and tail, graceful and sprightly movement, it is a very attractive little animal. It has been found to have small cheek-pouches. Its length rarely exceeds four inches, its tail being nearly as long. In different sections of the country its markings and habits are varied, and in some it seeks a home in the human dwelling, as do other mice.

**Deer-stalking**, an exciting but laborious mode of hunting the red-deer, in which, on account of the extreme shyness of the game, their far-sightedness and keen sense of smell, they have to be approached by cautious manœuvring before a chance of obtaining a shot occurs. Great patience and tact and a thorough knowledge of the ground are essential to a good stalker, who has to undergo many discomforts in crouching, creeping, and wading through bogs, etc. Advance from higher to lower ground is usually made, since the deer are always apt to look to the low ground as the source of danger. "Deer-driving" toward a point where the shooters are concealed is often practised, but is regarded as poor sport by the true deer-stalker.

**Deerfield**, Mass., a town of Franklin County, on the Connecticut River, and the Boston & Maine, and the New York, New Haven & Hartford R. R.'s; 33 miles north of Springfield. It is an agricultural region, and its industries are chiefly related to agricultural products. It has a high school and public library. The town contains the village of South Deerfield, and in colonial times was the scene of several contests with the Indians. Among them were the "Bloody Brook Massacre" (1675), and the burning of the village by the French and Indians under De Rouville (1703). Old Deerfield has a beautiful soldiers' monument, and there is at South Deerfield a marble monument commemorative of the Bloody Brook disaster. Eliza Allen Starr, author and art teacher, was born in Deerfield. Pop. (1900) 1,969.

**Deerfield River**, a river in Massachusetts, rising in southern Vermont and flowing generally southeast for 60 miles, when it enters the Connecticut River. The great fall of the river of nearly 1,100 feet in 50 miles furnishes water power at many places, of which the chief are at the Hoosac Tunnel and Shelburne Falls. Several streams nearly as large as the main river enter it from the north.

**Deerhound**, a Scotch greyhound, with a shaggy coat, covering his body, except the legs and tail. He is somewhat heavier than the English breed of greyhound, as well as somewhat larger. As the name suggests, this dog was employed for deer-hunting; and one of its older names was "buckhound."

**Deerslayer**, *The*, the last published (1841) of the 'Leatherstocking Tales,' by J. Fenimore Cooper, though written many years before its appearance. See **NATTY BUMPUS**.

**De Facto**, *dē fāk'tō* (Lat. "in fact"), a legal term used in contradistinction to *de jure* (by right). It is commonly used in regard to governments, some of which are supposed to be based on divine right, others on usurpation. A *de facto* government, when established, is now always recognized as *de jure*. The term *de facto*

is often applied in ordinary administrative law to designate the practice of illegal authority which has been exercised under apparent right.

**Defamation**, the speaking or writing words of a person so as to hurt his good fame. Written defamation is termed libel, and oral defamation slander. The provisions of the law in respect of defamation, written or oral, are those of a civil nature, which give a remedy in damages to an injured individual; or of a criminal nature, which are devised for the security of the public. Slander was recognized as an individual wrong, and an offense against the public peace, at an early period of the English law. Libel was hardly known. This, however, is not strange; it is not to be supposed that it would have been, among an illiterate people, few of whom could write, and not many could read. Until education and learning had made considerable progress, and with them the arts and sciences, the offense of libel was comparatively rare. Libel had only very narrow limits in rude and despotic times, and not the same precision it has acquired in the days of liberty and science. As soon as writing became general it was used for abuse. People became jealous of their characters and reputations, which they found were thus in the power and at the mercy of every malicious writer, and then they claimed, as one of their first and absolute rights, the protection of character and reputation against a weapon more potent than slander, because committed to writing, and consequently more lasting and impressive and more dangerous to society. This was the mischief which the law of libel was designed to restrain. And when printing came into more general use it became more and more apparent that the law of libel was founded in reason and justice, and thus as learning progressed the law of defamation spread its influence, and finally placed a wholesome restraint upon the printing-press, as well as upon the instruments of the author, the critic, the painter, and the poet. The law forbids revenge, and the tongue is restrained. Character and reputation are treated as the safeguards of social position and success in life. They have always been recognized as absolute individual rights. Libels and defamations are classed as private injuries of the highest degree by Justinian in his 'Institutes.' Words are slanderous, and actionable *per se*, which impute to the party the commission of some criminal offense involving moral turpitude. Words which impute to the party spoken of unfitness to perform the duties of an office or employment, or which charge that a party is infected with a contagious disease, etc., are slanderous. A libel is anything which is written, printed, published, or pictured, calculated to injure the character of another by bringing him into ridicule, hatred, or contempt.

**Default**, a failure to appear in any court on the day assigned; especially applied to a defendant when he fails or neglects to plead or put in his answer on an appointed day. In such cases the plaintiff is entitled to sign judgment against him, which is called judgment by default, and the defendant is said to suffer judgment by default.

**Defaux**, *Alexandre*, *ä-léks-ändr dē-fō*, French landscape painter: b. Bercy, near Paris, 27 Sept. 1826. He was a pupil of Corot, and his paintings display remarkable understanding of

perspective. He began to exhibit in the Paris Salon in 1859 and among his numerous landscapes are: 'View at Caen'; 'Abandoned Race Course at Ivry'; 'View of St. Maur, Coast of Gravelle' (1863); 'Evening in Spring' (1869); 'Fine Winter Day in Bas Meudon' (1873); 'The Loire after a Flood' (1873); 'Birches at Fontainebleau' (1874); 'Gravel Pit at Fontainebleau' (1877); 'Forest of Fontainebleau' (1879); 'Harbor of Pont-Aven' (1880); 'Old Birch-trees at Pigeon Pond in Fontainebleau'; 'Low Tide in Normandy' (1884); 'After the Storm' (1885).

**Defeasance**, *dē-fē-zans*, **Deed of**, in law, an instrument which defeats the force or operation of some other deed or estate; and that which in the same deed is called a condition, in a separate deed is called a defeasance.

**Defectives**, **Education of**. Systematic care of the defective classes began in America in 1815, when a young theological student, Thomas Hopkins Gallaudet (q.v.), started for Europe to study methods of teaching the deaf and dumb. A school for this class was opened in 1817, one for the blind in 1831, and one for the feeble-minded in 1845—practically 15 years apart. In each case the first schools were in New England, the second in New York, the third in Pennsylvania; and these schools followed one another quickly. All started in the face of more or less distrust as to their feasibility, and all were experimental, being started through private initiative. A few pupils were taught and exhibited before the amazed public, when in the case of the deaf and the blind private funds in abundance were contributed and the schools quickly established as private corporations. In the case of the feeble-minded the first school to be incorporated was a public organization—that is, it was supported by the State. Before 1822 the State had not been educated to the point of supporting schools for the special classes, but by 1848 it was ready to see its duty toward even the idiotic. The three States named having led the way, the movement spread quickly into Ohio, Kentucky, Virginia, and Illinois—in almost identical order for each special class. Here, however, the schools arose as State institutions. It had become an accepted part of public policy for the State to provide a means of education for all her children. The superintendents of the early schools for the deaf and dumb were generally clergymen; those of the blind and the idiotic, generally physicians. The institutions were necessarily boarding schools; and the early ones were established as a rule in or near the State capitals, chiefly that their achievements might be kept before the members of the legislatures, on whose practical sympathy their continuance usually depended. The large private or semi-public institutions are confined to the eastern States. Their support comes chiefly from private bequests and the interest on invested endowment funds. All, however, receive what is termed State aid, and make annual report to the State legislatures, to the commissioners of public charities or of public education. All are governed by honorary boards of trustees or managers, who appoint the superintendent or principal. In the semi-public organization the managers form a self-appointing, close corporation; in the public, they are appointed usually

by the State governor, by whom they may also be removed. The semi-public institutions are usually well endowed. Their expenditures are, thus, not limited by legislative grant; and they are free from political interference, an influence which has sometimes seriously affected the State institutions. As a rule, the institution plants are large and well equipped, and even when in cities have ample lawns and playgrounds. The earlier institutions were built on the congregate plan; the later have generally adopted the segregate or cottage plan. The pupils are not committed to these institutions, but are admitted or rejected by the boards of trustees on the recommendation of the superintendents. The early institutions for all three classes of defectives began purely as schools. And all those existing to-day, except those for the feeble-minded, discharge or graduate all pupils after these have completed the course of instruction. A very recent movement, started by the instructors of the deaf, is the affiliation of the educators of the defective classes with those of the national education association. It is being more and more recognized that the line between a defective and a normal child cannot be drawn hard and fast, and that many a child who appears dull and stupid in school is in some measure defective. Systematic work for the deaf and dumb, the blind, and the feeble-minded began in France, and from France America learned the early methods.

*The Deaf*.—About the middle of the last century three schools for the deaf and dumb were opened in Europe. Though they sprang up about the same time they were wholly independent in origin. In Paris the Abbé de l'Épée having observed two deaf-mute sisters conversing by means of gestures, seized upon the idea that in gesture language lay the secret of instructing the deaf and dumb. He therefore elaborated a system of gesture signs and made it a medium of instruction in the school which he started. Heinicke in Dresden and Braidwood in Edinburgh simply adopted articulate speech as the language of man and taught their pupils through it, requiring them to speak and read the lips of others. Reports of their success having reached America, several parents of deaf-mutes sent their children to Scotland to be educated. These deaf children returned no longer as mutes; they were able to converse readily by speaking and lip reading. One of these parents published a book in London, wrote articles for the New England periodicals, with the intention of arousing interest in the new work, and took steps to ascertain the number of deaf-mutes in Massachusetts. In 1812 a little school for deaf and dumb pupils was opened in Virginia, having for teacher one of the Braidwood family, who had come to America. The school was the first of its kind in America. It was soon given up, as was a similar effort in New York. These events though seeming to result in little, yet had great effect in directing intelligent attention to this field of work.

A physician of Hartford, Conn., one of whose little daughters had become deaf, spent eight years in agitating the question of starting a school for such children. Thomas Hopkins Gallaudet was sent abroad to study methods. He went to Great Britain to study the only method that Americans knew about; but the

## DEFECTIVES

doors of the British schools were closed to him. He found the science and art of teaching the deaf regarded as a business monopoly. After nine months he gave up hope of acquiring the Braidwood method and spent at the Paris school the three remaining months of the year. This time being far too short he induced a deaf-mute teaching in the school to accompany him to America. This was the brilliant and accomplished Laurent Clerk, who became an engine of power for establishing schools for deaf-mutes in our country. The French method or sign-language method was improved and further systematized by our early teachers and in this form was the basis of instruction in all our schools for half a century. During the absence of Dr. Gallaudet the Connecticut Asylum at Hartford had been incorporated, but soon changed its name to the American Asylum, for it was then supposed that one school could accommodate for many years all the pupils of the country. Upon Dr. Gallaudet's return he and Mr. Clerk traveled for eight months among prominent cities in behalf of the cause of the deaf. On 15 April 1817 school work began at Hartford with seven pupils. During the year 33 pupils came. This was the first permanent school in the country. The founders of our schools differing from practice abroad, immediately established theirs on a permanent basis. Private aid was necessary at first, but no sooner had the feasibility of the work been shown than public moneys were granted.

In 1818 a school was opened in New York under a teacher from Hartford. In Philadelphia a little class started in 1819 was organized as an institution in 1820. In 1819 Massachusetts had provided an appropriation for the education of 20 indigent pupils at Hartford, and in 1825 New Hampshire and Vermont adopted the same policy, being soon followed by other States. Thus, through the efforts of the founders of the Hartford school, the policy of educating deaf-mutes at the public expense was firmly established in the United States, and has been adopted with few exceptions. Some of the western States secured means for the education of deaf-mutes by constitutional provision. Two years after the founding of the Pennsylvania school, Kentucky followed with its institution, being the first to be supported by a State. Ohio and Virginia soon followed. Thereafter institutions sprang up rapidly in the South and West. In 1857 there was incorporated by Congress the Columbia Institution at Washington, D. C., which requires special mention. Though originally intended as a school for educating the deaf children of government beneficiaries, a change largely owing to the energy of its principal, Dr. Edward M. Gallaudet, soon enabled the institution to confer collegiate degrees. It was then divided into two departments, the advanced taking the name of the National Deaf-Mute College. Thus, in 1864, America had taken a step "unprecedented in the history of deaf-mute instruction."

Most of the deaf and dumb are either born deaf or become so before acquiring language. They are dumb because they are deaf, and without special instruction can never know any but a gestural language. The pioneer educators of the deaf in this country were all "broad-minded men of liberal education," and they set a high standard at the outset for the work. A

language of signs they saw was the key to the instruction of their pupils, who, indeed, were allowed so few years of schooling, that no time was to be lost in laboring over the extraordinary difficulties of teaching them speech. The language of signs is ideographic—"being readily expressive of ideas and emotions," rather than of phraseology. Put into words their order is very different from the natural order. The late superintendent of the Illinois institution, Dr. Gillett, writes: "When reduced to a system they [signs] form a convenient means of conveying to one mind the ideas conceived by another, though not clothed in the language in which a cultured mind expresses them. One addressed in the sign language receives the idea and translates it into English without any intimation of the phraseology in the mind of the speaker, so that a dozen persons familiar with the sign language, observing the gesticulations of a speaker, would each translate correctly the thoughts given forth, but no two of them would be in exactly the same phraseology. It is a concrete language, in which the expression of abstract ideas is exceedingly difficult." As the ideas are given out chiefly by means of hand gestures, schools using the sign language as a means of instruction are said to follow or use the manual method. Among the manually taught deaf this language early becomes the vernacular. As it is a language of living pictures, such deaf people think in pictures and dream in them. The sign language is said to be to the deaf what spoken language is to the hearing; and yet its use in the school room is deemed by many teachers extremely detrimental to the acquisition of the English language, which all our educators of the deaf agree is their chief end and aim for their pupils. They differ widely, however, over the use of signs. The greater number believe a moderate use of them to be economical of time and extremely useful to the deaf in the acquisition of knowledge. There is a small but growing number who dispense with signs *in toto* just as soon as possible. These latter teach by the intuitive, direct, or "English language method." They teach English by and through English, spoken, read, and written. It is extraordinarily difficult to get started by this oral method. But its advocates claim that once well started their pupils advance more logically, more surely, more precisely, and finally more swiftly than pupils allowed to use signs. Advocates of using the signs together with other means claim that the minds of most of their new pupils are sluggish from want of language to think in, and that they need to be aroused by the quickest method. They assert that "A large percentage of the deaf under proper methods can obtain a very useful amount of speech and lip-reading, but [that] there is also a large percentage of them that would be greatly restricted in their mental development, if allowed no other means of instruction." A proper and conservative use of the sign language always tends to mental development, saves time, and is the most efficient aid known in the acquisition of written and spoken language." The other school affirms that the two methods or systems are mutually exclusive, saying: "Of course no pupil can be taught under the intuitive and the sign method at the same time, and it is impossible to combine into one system a method which is depend-

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ent upon the sign language at every stage of instruction with a method which dispenses absolutely with the sign language at every stage in teaching the English language. In the sign-language method instructors aim to teach the vernacular language through the intervention of signs, but their deaf-mute pupils acquire a mixture of natural signs, pantomime, conventional signs and finger spelling which becomes the habitual vehicle of thought and expression, wherever it is possible to use a gestural language, to the exclusion of the English language." A form of the English language method, taught at the Rochester, N. Y., institution, substitutes finger spelling for signs as these methods are used in manual schools, and is called the "manual alphabet method."

The history of the rise of the oral method is interesting. As has been said, the manual method reigned supreme for the first 50 years of the work. In 1843 Horace Mann, secretary of the Massachusetts State Board of Education, and Dr. Howe, director of the Perkins Institution for the Blind in Boston, made a tour of Europe. In his next annual report Horace Mann praised the oral method as taught in Germany, stating that it was superior to the method employed in America. The report was widely read, and caused no little commotion among our teachers of the deaf. Several went abroad to see for themselves, but did not agree with Horace Mann, and little change was then made in American methods. Still as a result of their recommendations, classes in articulation were introduced into several schools. Later, in 1864, there was an agitation in Massachusetts for the incorporation of an oral school in that State, and a small private school of the kind was soon opened near Boston. In 1867 the Clarke Institution (named for its founder) was incorporated by the Massachusetts legislature, and was opened as an oral school. In the same year a former teacher of an Austrian school opened in New York what soon became the New York institution for the improved instruction of deaf-mutes. Dr. Edward M. Gallaudet after investigations abroad reported that if the whole body of the deaf were to be restricted to one kind of instruction, he favored results to be obtained by the manual methods of America, but he advocated the introduction of articulation into all the schools of the country. A conference of principals of American institutions adopted resolutions in the line of President Gallaudet's recommendations, and classes in articulation were very generally introduced. During the next few years a gradual movement abroad toward the abolition of signs was evident; and at the second international conference at Milan in 1880, an overwhelming majority of the delegates present voted in favor of the oral method. American instructors of the deaf paid more and more attention to the question of methods, and conventions of articulation teachers were held. In the meantime Dr. Alexander Graham Bell had introduced to teachers his father's system of visible speech (q.v.). A similar but simpler system of visible speech symbols had been independently worked out by a Mr. Zera Whipple, of Mystic, Conn.; and more recently the Lyon phonetic manual has been devised, which is founded on the principle of visible speech and may be written in the air by the fingers. In 1888 the royal commission of the United King-

dom voted "that every child who is deaf should have full opportunity of being educated on the pure oral system," but that those found physically or mentally disqualified "should be either removed from the oral department of the school or taught elsewhere on the sign and manual system." In 1890 the American association to promote the teaching of speech to the deaf was incorporated, with Dr. Alexander Graham Bell as president. Dr. Bell immediately endowed the association handsomely. It cannot be denied that at times the controversy over methods has been bitter; to-day, however, it has been reduced to a generous rivalry, in which the champions of the various methods and systems are striving earnestly to find out the best means of instructing the deaf and to pursue it. The majority of our schools do not limit their teaching to any one method, but are eclectic, calling themselves "combined system" schools. The work for the deaf in this land has progressed remarkably. No other country has so many deaf pupils under instruction as this has, none has provided so generously for them, and there is none in which their educators are more alert to test new inventions and appliances that may bear upon the methods of instruction. And yet, unquestionably, the education of the deaf is still in its youth.

Soon after the beginning of the work 'The Annals of the Deaf' was started (now in its 44th volume). It is said to be the leading publication of its kind in the world. Its editor, Dr. Edward A. Fay, has made a most thorough investigation into the results of marriages of the deaf. The Volta prize of 25,000 francs awarded by the French government to Dr. Bell for his invention of the telephone, he applied to the founding of a bureau for the purpose of collecting and diffusing knowledge concerning the deaf. This is the Volta bureau of Washington, D. C. It has already published a large number of papers, studies, and books. The influence of Dr. Bell upon the work for the deaf has been deep and lasting. The invention of the telephone itself resulted from his experiments upon a device which he hoped would enable the deaf to read the vibrations of the human voice. Though a Scotchman by birth, he is practically an American, and has devoted his best energies and his means to furthering the work which he has made his profession. His great efforts have been toward the promotion of speech-teaching to the deaf.

As Dr. Gillett has said, "The instruction of the deaf is one of the most difficult fields in the entire department of education for achievement at once successful and satisfactory to the teacher." For many years the parent school at Hartford was parent in the sense of providing principals and teachers for other schools. The New York institution has also furnished schools with many officers and teachers. It is only within comparatively recent years that normal classes, as such, have come to exist in a few of the schools. Among others, the Clarke Institution, the Wisconsin Phonological Institute, the school at Bala, Pa., and Gallaudet College have them—the latter announcing that it has opened to a limited number of college graduates annually, normal fellowships of \$500, tenable for one year. Thus has the standard of deaf-mute teaching come to be in line with

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modern university methods of training teachers. Public day schools for the deaf have sprung up in various places. The Horace Mann School of Boston is a notable example. They fill an unquestioned need, as many parents refuse to send their deaf children off to an institution. A still further movement toward decentralization has come to pass in Wisconsin. Wherever in this State a few deaf children can be gathered near their homes, State aid will be given to pay teachers sent there to teach them. And this movement is tending to become more and more general. All these day schools spread the oral method. An important effect of the rise of this method has been the lowering of the age when deaf children are received, and of lengthening their term of instruction; also of largely increasing the number of women teachers employed. The Home at Bala for the training in speech of little deaf children before they are of school age, takes them at the age when normal children learn to talk and teaches speech by talking to them and having them talk back as if they heard. There are several private oral schools for the deaf in this country where the pupils pay tuition. One of the best is the Wright-Humason school in New York. With the lowering of the age of pupils, kindergarten methods have been made use of more and more; though no true kindergarten can be conducted in schools where language comes so hard and so late, where even natural signs are arbitrarily interdicted, and where there can be no music. But the occupations and the games are widely applicable and are now universally used. The first duty of the teacher is to establish communication with the deaf child and thereafter, during his whole course at school, more than in any other kind of educational work, to make language the end of training and other subjects the means of varying language teaching. This statement is strictly true only of elementary education, but then the majority of deaf pupils do not advance far beyond the elementary stage, because so very much time is absorbed in language work that their progress in other things is slow; then, too, parents are prone to call their boys away from school as soon as they believe these can help sustain the family. A few of the brighter and more ambitious pupils from the schools take the course at the National Deaf-Mute College, now called Gallaudet College, where they have "an opportunity to secure the advantages of a rigid and thorough course of intellectual training in the higher walks of literature and the liberal arts." Occasionally we hear of deaf pupils taking high school work in schools with hearing pupils, and even of being graduated from colleges of the hearing.

The course of training at American schools for the deaf has always been practical. Indeed, industrial training is almost essential for those young people who would form industrious habits and facility in the use of tools, that will put them on their feet when they enter the world of labor; for most deaf pupils will have to work for their living. The trained deaf are not at all disqualified from self-support by simple inability to hear. In their schools general manual training is followed with a pupil until, for one reason or another, he chooses his trade or it is chosen for him. The general equipment for trade teaching is excellent. Printing is an ex-

tremely useful occupation for the deaf, especially in the acquisition of idiomatic language; and every institution for their instruction publishes one or more papers. Our educated deaf people form a quiet, well-behaved, self-supporting part of the community. They have formed local and national societies for mutual benefit. The convention of the deaf that met in 1893 at the Columbian Exposition at Chicago was the largest meeting of the kind ever held. Their speeches and deliberations and social gatherings occupied several days. Within the grounds of Gallaudet College at Washington stands a beautiful memorial statue of Gallaudet teaching a little deaf and dumb girl. It was presented to the college by the deaf of the whole country. In this memorial the deaf have made fitting recognition of their indebtedness to education.

*The Deaf-blind* — "Obstacles are things to be overcome" is the motto given by Dr. Howe to the Perkins Institution for the Blind. When this remarkable man learned in 1837 that up in the mountains of New Hampshire there was a little girl not only blind but also deaf and dumb, he eagerly sought out the child and obtained the parents' consent to take her to South Boston to be educated. He had already formed a theory as to how he would reach a mind thus doubly shut in, and with the finding of Laura Bridgman came the wished-for opportunity to test this theory. It should be noted that Laura Bridgman saw and heard until she was two years old. She had been rather a delicate child, however, having enjoyed only about four months of robust health, when she sickened, her disease raging with great violence during five weeks, "when her eyes and ears were inflamed, suppurated and their contents were discharged." Her sufferings continued for months, and it was not "until four years of age that the poor child's bodily health seemed restored." She was intelligently active, following her mother about the house, seeming anxious to feel of everything, and thus to learn about it; and she developed signs for her father and her mother, and for some things.

She was eight years old when brought to the Perkins Institution. Dr. Howe writes: "There was one of two ways to be adopted: either to go on and build up a language of signs on the basis of the natural language, which she had already herself commenced, or to teach her the purely arbitrary language in common use; that is, to give her a sign for every individual thing, or to give her a knowledge of letters, by the combination of which she might express her idea of the existence, and the mode and condition of existence, of anything. The former would have been easy, but very ineffectual; the latter seemed very difficult, but, if accomplished, very effectual; I determined, therefore, to try the latter." After the child had become adjusted to the change of homes, Dr. Howe began teaching her by means of common articles with which she was familiar — spoons, forks, keys, etc., on which labels with their names printed in raised letters had been pasted. Similar detached labels were given her to feel. Her touch was acute enough, hence she was able to match labels, placing that for book on the book, etc. She did this easily and willingly because she received approbation for so doing; but the idea that the printed word stood for the name of the object had not entered her brain. Then other detached



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labels were cut up into their component letters. These her memory soon enabled her to build into wholes or the words she had felt. Such exercises continued for many weeks to be only a meaningless play to the poor child. The success had been "about as great as teaching a very knowing dog," when suddenly the idea flashed upon her that "Here was a way by which she herself could make up a sign for anything that was in her own mind, and show it to another mind, and at once her countenance lighted up with a human expression; it was no longer a dog or parrot,—it was an immortal spirit, eagerly seizing upon a new link of union with other spirits! I could almost fix upon the moment when this truth dawned upon her mind, and spread its light to her countenance; I saw that the great obstacle was overcome, and that henceforward nothing but patient and persevering, plain and straightforward efforts were to be used." Next, she was given metal type each bearing some embossed letter, and a frame with holes to receive them. With this appliance Laura readily wrote the name of any object she knew and by writing them fixed in mind an extensive vocabulary of common names. Then the less cumbersome manual alphabet was taught her. Here was a means by which she could both write and read; she could spell to her teacher and read what her teacher spelled into her hand. Dr. Howe's reports teem with interesting psychologic material. At the end of the year he writes: "She is nine years of age, and yet her knowledge of language is not greater than a common child of three years. There has been no difficulty in communicating knowledge of facts, positive qualities of bodies, numbers, etc.; but the words expressive of them, which other children learn by hearing, as they learn to talk, must all be communicated to Laura by a circuitous and tedious method. In all the knowledge which is acquired by the perceptive faculties, she is of course backward; because, previous to her coming here, her perceptive faculties were probably less exercised in one week than those of common children are in one hour." And so her instruction went on. Through it all the child showed an eagerness to learn and to put herself in touch with the world that was a powerful aid to the teacher. In a few years, when Oliver Caswell, also deaf, dumb, and blind, came to the institution, Laura naturally took great interest in teaching him, and thereby profited much herself. As she approached womanhood her education was already good. She had learned to sew, to knit, and to do fancy work. She often visited her home, but her true home was the institution; there she died in her 60th year, the first case of any one so afflicted made capable of leading an industrious and happy life, and as the first case, historically the most remarkable. Popular interest in Laura Bridgman, both in this country and abroad, was naturally very great. The printed reports of her progress which were eagerly awaited were as eagerly absorbed. Distinguished foreigners coming to Boston visited her. Charles Dickens wrote in his *American notes* a sympathetic account of his impressions of her. The way to give liberty to the imprisoned mind had been made plain.

In the year 1887 something like the old interest was aroused by accounts of the brilliant deaf, dumb, and blind child in Alabama, Helen

Keller. This child had lost sight and hearing at 19 months as a result of a serious illness. Like Laura she kept actively interested in all that surrounded her, and like Laura she developed her own little language of signs. When she was six years old, her friends, who knew of Laura Bridgman's case, applied to Boston for a teacher. In the following year Miss Annie M. Sullivan was sent. This lady was able to put herself in touch with Helen in a very short time and in a marvelous way. In fact, she has proved herself to be a most remarkable teacher. Following in general the methods adopted in teaching Laura, Miss Sullivan began her work by putting Helen in possession of the manual alphabet. A doll was happily chosen to begin with; and with the doll on the child's lap, the teacher formed in Helen's hand the finger letters *d-o-l-l*. Other familiar objects were similarly introduced, and strange as it may seem, that which had taken three months to reach in Laura's case in Helen's took but a few days; or, in Miss Sullivan's words, "it was not more than a week before she understood that all things were thus identified." Her teacher writes: "Never did a child apply herself more joyfully to any task than did Helen to the acquisition of new words. In a few days she had mastered the manual alphabet and learned upward of 100 names." After teaching verbs and prepositions through action and position Miss Sullivan made a departure. She began to use new words in connection with old words, letting Helen understand them if possible from the context. The child adopted these words "often without inquiry." In this way she became familiar with the use of many words whose meaning never had to be explained to her.

As to the letters of the raised alphabet, Miss Sullivan writes: "Incredible as it may seem, she learned all the letters both capital and small in one day." Then came the primer; then pencil writing than which there is scarcely a more difficult exercise for the blind to learn; and yet Helen "wrote without assistance a correctly spelled and legible letter to one of her cousins; and this was only a little more than a month after her first lesson in chirography." Braille, or tangible point writing, became a constant delight to her.

Words like "perhaps" and "suppose" and those indicative of abstract ideas she learned more through association and repetition than through any explanation of her teacher. The child had the language sense largely developed. Much of the time when no one was talking with her she was reading in books printed in raised letters. Dr. Bell in trying to account for Helen's wonderful familiarity with idiomatic English, considers of great significance the statement of Miss Sullivan, that, "long before she could read them [the books] . . . she would amuse herself for hours each day in carefully passing her fingers over the words, searching for such words as she knew." In 1888, when Helen was eight years old her teacher took her to South Boston, where she could have the advantage of all the appliances and embossed books that a school for the blind affords. Thenceforth an account of her progress reads like a romance. It was no more difficult for her to learn a new word in German or in Greek than in English; and she took great delight in picking up and using French or Greek phrases.

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And when later she came to study these languages, she seemed to advance without effort in the knowledge of them. The educators of the deaf, who have good reason to comprehend the exceeding difficulty of teaching their pupils to articulate intelligibly, feel that Helen Keller's rapid mastery of speech is by all odds her most wonderful achievement. After she had been in South Boston some little time she heard of a Swedish girl afflicted like herself, who had learned to speak, and she said, "I must learn to speak." Miss Sullivan took her to Miss Sarah Fuller, principal of the Horace Mann School for the Deaf, and though Helen's only means of learning the position of the vocal organs in speech was to put her fingers on the lips, tongue, teeth, and throat of the speaker, she learned in 10 lessons to articulate so well that she could carry on an intelligible and audible conversation, having communication addressed to her spelled into her hand by the manual alphabet. She has learned since that time to read from the lips and throat of a speaker by placing her fingers lightly on them; so that any one sitting near her can converse with her just as though she could both hear and see. She spent a winter at the Wright-Humason Private School for the Deaf, where she improved her articulation. When Helen was 16 years old she entered the Cambridge School for Girls, Miss Sullivan accompanying her. There, under the guidance of Mr. Arthur Gilman, the director of the school, she took the course preparatory to entering Radcliffe College. At the end of one year she took the regular required examinations in the history of Greece and Rome, in English, in Latin, in elementary French, in elementary German, and in advanced German. As the questions and other matter were read into her hand by Mr. Gilman himself, Helen wrote her answers and translations on an ordinary typewriter. She passed the tests in every subject, taking "honors" in English and German. Mr. Gilman writes: "I think that I may say that no candidate in Harvard or Radcliffe College was graded higher than Helen in English." There are still other children afflicted like Helen who are doing splendid work, but, "taking this child all in all," says Dr. Job Williams, principal of the American School for the Deaf at Hartford, "and making due allowance for every possible aid that has been given her, and for all unconscious exaggeration due to friendly admiration, there yet remains so much that is marvelous as to place her beyond comparison with any other child of whom we have ever heard. The whole history of literature reveals nothing equal to her language productions from one of her years, even among those possessed of all their faculties. She is a genius, a prodigy, a phenomenon." The other deaf-blind children under instruction are some at schools for the blind, some at schools for the deaf. They must always have a special teacher, and use embossed books and adapted appliances. All are being taught on principles used in teaching Helen. In South Boston, where there are several, they attend classes with other pupils, the special teacher acting simply as interpreter and companion. See BLIND, EDUCATION OF; BRAILLE, LOUIS; FEEBLE-MINDED; HOWE, SAMUEL GRIDLEY.

EDWARD ELLIS ALLEN,

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*Bibliography.*—(*The Deaf*).—Bell (A. G.), 'Condition of Articulation Teaching in American Schools for the Deaf'; 'Deaf-mute Instruction in Relation to the Public Schools'; Bell (A. M.), 'English Visible Speech'; Fay (E. A.), 'Marriages of the Deaf in America'; Gallaudet (E. M.), 'The Combined System of Educating the Deaf'; Gordon, 'The Education of the Deaf' (Volta Bureau 1892); 'Notes and Observations on the Education of the Deaf'; Green, 'Vox Oculis Subjecta,' part 1 (Boston 1897); 'Histories of American Schools for the Deaf,' three volumes (1893); Hubbard, 'The Story of the Rise of the Oral Method in America' (Washington 1898); Johns, 'The Land of Silence and the Land of Darkness' (London 1857); Kitto (John), 'The Lost Senses' (1845); Proceedings of American Association to Promote the Teaching of Speech to the Deaf. See also Bibliography of DEAF-MUTES.

(*The Deaf-blind*).—Prof. Anagnos, 'Helen Keller'; Fuller (Sarah), 'How Helen Keller Learned to Speak' (Annals of the Deaf, Jan. 1892); Dickens, 'Account of the Institution for the Blind at Boston' ('American Notes,' London, 1842); Gilman, 'Miss Helen Keller's First Year of College Preparatory Work' (Volta Bureau 1897); Howe, 'Education of Laura Bridgman' (Extracts from reports); Lamson (Mary S.), 'Life and Education of Laura Dewey Bridgman'; Sullivan (A. M.), 'How Helen Keller Acquired Language' (Annals of the Deaf, April 1892); 'The Language of the Deaf-blind' (Annals of the Deaf, April 1899).

**Defence of Poesie, The.** The title given to Sir Philip Sidney's 'Apologie for Poetrie' when printed for the second time in the third edition of the 'Arcadia' in 1598.

**Defendant,** in law, the party against whom a complaint, demand, or charge is brought, in a civil or criminal proceeding; one who is summoned into court, and defends, denies, or opposes the demand or charge, and maintains his own right. The term is applied even if the party admits the claim.

**Defender of the Faith** (*defensor fidei*), the title bestowed on Henry VIII. of England by Pope Leo X. (1521) in recognition of the monarch's great service to the Roman Catholic Church in writing his *Assertio Septem Sacramentorum adversus Martinum Lutherum* (vindication of the seven sacraments against Martin Luther). Pallavicini, in his history of the Council of Trent, describes the great satisfaction given to the papal court by King Henry's book and the modes suggested by various cardinals of acknowledging the obligation to the monarch. The Pope, with the aid of his secretary, Sadolet, had a form of bull drawn up conferring on Henry the title "Defender of the Faith." So that he might be on a par in the matter of titles relating to religion with the king of Spain's "Catholic majesty" and the king of France's "most Christian majesty," Henry was to be "Defender of the Faith." The draft of the bull was read to the college of cardinals and one of them suggested that the fittest title for the king of England would be "Orthodox King" or "Orthodox Majesty"; another proposed "Apostolic King"; a third "Angelic King." But Wolsey had already

signified to the court of Rome his royal master's choice of the title *Defensor Fidei* and accordingly that was adopted.

**Defenders**, a Roman Catholic association in Ireland (1784-98), the opponents of the Peep o' Day Boys.

**Defensor Matrimonii**, or **Defensor Vinculi Matrimonialis**, Defender of the Marriage Tie, an official in every episcopal jurisdiction of the Roman Catholic Church, whose duty it is in all cases of petitions or suits for judicial separation of married couples or for annulment on whatever ground of marriage contracts or of the marriage relation, to defend with all his power the validity of the contract and resist its abrogation. The Defensor is required to be in person present at every stage of the trial of a matrimonial cause, and he must have access to all the records and all the testimony. Not only may he, in case the court decides for the nullity of the marriage, appeal to a court of second instance; he is under obligation to appeal every single case; and if he demands it, he must be allowed a further appeal to the highest court. Nor is that all; he has the right, and it is his duty, to open the case anew if he finds there was any serious flaw in the judgment of nullity. In short, a matrimonial cause involving nullity of a consummated marriage contract is in the Church of Rome never finally and absolutely determined so long as either of the two parties to the suit is living.

**Deffand, Marie de Vichy-Chamrond**, *mā-rē dē vē-shē-shān-rōn dēf-fān*, MARQUISE DU, French letter writer: b. Château de Chamrond, France, 1697; d. Paris 24 Sept. 1780. Her acquirements were very considerable, but no care seems to have been taken to regulate her temper and disposition, which were marked by a high degree of selfishness, conspicuous throughout her life. In 1718 she married the Marquis du Deffand, from whom she separated after 10 years. During the latter part of her long life she became the centre of a literary coterie, which included some of the greatest geniuses of the age. Among women remarkable for their wit and talents in the 18th century Madame du Deffand claims a distinguished place, though she left no monument of her abilities except her epistolary correspondence, highly praised by D'Alembert as affording a model of style in that species of composition. During the last 30 years of her life she was blind. In 1810 was published 'Correspondence inédite de Madame du Deffand, avec D'Alembert, Montesquieu, le Président Hénault, la Duchesse du Maine; Mesdames de Choiseul, de Staël; le Marquis d'Argens, le Chevalier d'Aydie, etc.' Her letters to the celebrated Horace Walpole have likewise been printed.

**Defiance**, Ohio, city, county-seat of Defiance County; on the Maumee River, the Wabash, and the Baltimore & Ohio R. R.'s, and the Cincinnati and Toledo canal; 50 miles south of Toledo. It is a trade centre and has woolen-mills, bicycle factories, machine and carriage shops, a national bank, daily and weekly newspapers. Pop. 7,650.

**Defiance College**, a coeducational (non-sect.) institution in Defiance, Ohio; founded in 1884; reported at the end of 1902: Professors and instructors, 10; students, 125; volumes in the library, 3,000; grounds and buildings valued at

\$20,000; benefactions, \$500; income, \$2,500; number of graduates, 160; president, W. Mc-Reynolds.

**Defila'ing**, in military strategies, that branch of the science of fortification, the object of which is to determine, when the intended work would be commanded by eminences within range, the directions or heights of the lines of rampart or parapet, so that the interior of the work may not be incommoded by a fire directed to it from such heights.

**Defile**, in military language, is a narrow way, admitting only a few persons abreast. Hence to march before any one with a narrow front, in column or by files, is called defiling.

**Definite Proportions, Laws of.** See ATOMIC THEORY.

**Definition** (from the Latin *definitio*) of a thing signifies, in lexicography, a concise account of its essential and characteristic points. A definition should embrace all the essential properties of the object intended to be defined, and not admit any which do not belong to it, which is often extremely difficult, on account of the shades and gradations by which different things are blended. The most simple things are the least capable of definition, from the difficulty of finding terms more simple and intelligible than the one to be defined. According to the old scholastic logic, a definition must give the mark of the genus (*nota generalis seu genus*) and of the species (*nota specialis seu differentia specifica*); for instance, a barn is a building (*nota generalis*) for the purpose of preserving corn, etc., (*nota specialis*). According to Aristotle every strict definition could be divided into two distinct parts; one dealing with the genus, and the other declaring the specific difference by which the given subject varies from others of the same order. Kant and his followers on the contrary make definition merely a list of essential marks summed up without any distinction between genus and difference.

In *optics* definition means the defining power of a lens—the giving of a clear and distinct image of an object together with all details of importance.

**Defoe, Daniel**, English writer: b. London 1661; d. there, 20 April 1731. His father, whose name was James Foe, carried on the trade of a butcher. In 1685 he joined the insurrection of the Duke of Monmouth, and had the good fortune to escape to London, where he went into business, but was unsuccessful. He subsequently obtained an appointment under government, which he held from 1695 to 1699, and afterward engaged in various mercantile speculations. His business misfortunes, however, caused him to turn his attention to literature. In 1697 he wrote an 'Essay on Projects.' In 1701 appeared his satire 'The True-born Englishman,' designed to show the folly of the popular objection to King William, as a foreigner, by a people who were themselves a mixture of so many races. In 1702, when the High Church party seemed disposed to carry matters strongly against the Dissenters, he published 'The Shortest Way with the Dissenters,' an ironical recommendation of persecution, so gravely covered that many persons were deceived by it. It was, however, voted a

sedition libel by the House of Commons, 25 Feb. 1703; and the author avowing himself, to secure his printer and publisher, was prosecuted and sentenced to fine, imprisonment, and the pillory. He underwent the latter punishment with great equanimity, and was so far from being ashamed of it that he wrote a 'Hymn to the Pillory,' alluding to this circumstance. In February 1704, while in Newgate, he commenced the 'Review,' a sort of newspaper containing papers of literary and political criticism, supposed to be discussed by a scandal club. This paper was continued for nine years, and was entirely conducted by Defoe, even during protracted absences from England, in one of which, in 1710-11, he edited 45 numbers of the Edinburgh 'Courant.' In 1705 he wrote a short account of 'The Apparition of Mrs. Veal,' intended, it is said, to create an increased demand for a popular translation of Drelincourt on Death. This story, like others by Defoe, though told with great circumstantiality and appearance of good faith, is entirely fictitious. In 1706 he published his largest poem, entitled 'Jure Divino,' a satire on the doctrine of divine right. When the accession of the House of Hanover became an interesting topic he wrote in its favor, but so obtuse was the public to his irony that he was imprisoned for his productions as libels in favor of the Pretender. In 1715 he published 'The Family Instructor,' a work inculcating moral and religious duties in a lively manner, by narrative and dialogue. To this his well-known 'Religious Courtship' (1722) formed a third volume. In 1719 appeared the most popular of all his performances, 'The Life and Surprising Adventures of Robinson Crusoe,' the favorable reception of which was immediate and universal. The success of Defoe in this induced him to write a number of other lives and adventures in character; as 'Moll Flanders'; 'Captain Singleton'; 'Roxana'; 'Duncan Campbell'; and 'The Memoirs of a Cavalier,' pronounced by the Earl of Chatham the best history of the civil war extant. In 1722 he published a Journal of the Plague in 1665, in the person of a citizen supposed to have been a witness of it. In 1724 he published the 'Great Law of Subordination,' and in 1726 his 'Political History of the Devil,' to which he afterward added, in the same style of reasoning, wit, and ridicule, a 'System of Magic.' He is also author of a 'Tour through the Island of Great Britain'; 'The Complete English Tradesman, a Plan of English Commerce,' etc. See Wilson, 'Memoirs of the Life and Times of Daniel Defoe' (1830); Lee, 'Newly Discovered Writings of Defoe, with Life' (1869); Minto, 'Defoe' (1879); Wright, 'Life of Defoe' (1894).

**De Fon'taine, Felix**, American journalist: b. Boston, Mass., 1832; d. Columbus, S. C., 11 Dec. 1896. The first statement given to the North of the attack on Fort Sumter, was written by him; and he was correspondent of the *Charleston Courier* from the principal battlefields during the Civil War. Subsequently he went to New York, and was connected with the *Herald* much of the time until his death. He was the author of 'Cyclopædia of the Best Thoughts of Charles Dickens'; 'Gleanings from a Confederate Army Note-Book'; and 'Birds of a Feather Flock Together.'

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**De For'est, John William**, American novelist: b. Humphreysville, Conn., 31 March 1826. He passed many years in independent study and foreign travel, becoming a proficient in several languages; entered the army as captain at the outbreak of the Civil War, and rose to major; and since 1850 has been a fertile writer of essays, short stories, and novels for the leading magazines, taking prominent rank among American novelists. Among his works are: 'History of the Indians of Connecticut' (1853); 'Oriental Acquaintance' (1856); 'Witching Times' (1856); 'European Acquaintance' (1858); 'Seacliff' (1859); 'Miss Ravenel's Conversion' (1867); 'Overland' (1871); 'Kate Beaumont' (1872); 'The Wetherell Affair' (1873); 'Honest John Vane' (1875); 'Justine Vane' (1875); 'Playing the Mischief' (1876); 'Irene Vane' (1877); 'Irene, the Missionary' (1879); 'The Oddest of Courtships; or, The Bloody Chasm' (1881); 'A Lover's Revolt' (1898); 'Overland' (1899); 'The De Forests of Avesnes and New Netherland' (1900).

**Deformities.** In medicine deformities are deviations from the normal development of some part or parts of the body. These may mar the appearance from the æsthetic standpoint, or they may be internal or unknown, resulting in serious disturbance of health, or having no influence on the life processes whatever. Deformities may be congenital or acquired, in the former case usually being the result of defective development, in the second to some disease process. A number of forms of defective development result in the production of monsters (q.v.). Special characteristic deformities are harelip, congenital dislocation of the hip, web-fingers, supernumerary fingers, club-hands, congenital club-foot, bow-legs, knock-knees, and various minor anomalies. The commonest forms of acquired deformities are usually due to some disease of the nervous system, as acute spinal paralysis, acute anterior poliomyelitis of children. This latter causes paralysis of the arms or legs, which result in deformities from insufficient growth. Hemorrhage of the brain frequently occurring during childbirth may result in hemiplegia in the infant, with consequent deformities. Rachitis or rickets frequently induces deformities. Other forms of acquired deformity are hammer-toe and acquired club-foot, the latter usually resulting from paralysis.

**Defregger, Franz**, fränts dā-fräg-ër, German genre painter: b. Stronach 30 April 1835. The subjects of almost all his pictures are drawn from the Tyrolese peasant life, his few religious pictures having been in the main unsuccessful.

**De Fu'niak Springs, Fla.**, town, county-seat of Walton County; situated on the Louisville & Nashville R.R., 80 miles northeast of Pensacola, and about 25 miles north of the Gulf of Mexico. The industries of the place are those of an agricultural and fruit-growing country. It is the site of a State Normal School, and the Florida Chautauqua. Its population increased nearly threefold between 1890 and 1900. Pop. (1900) 1,661.

**De Gar'mo, Charles**, American educator: b. Wisconsin 7 Jan. 1849. He was graduated from the State Normal University of Illinois in 1873, was principal of public schools, Naples, Ill., 1873-6; professor of modern languages at

## DEGAS — DEGENERATION AS A FACTOR IN EVOLUTION

the State Normal University 1886-90; and president of the Swarthmore College 1891-8. Since 1898 he has been professor of the science and art of education at Cornell University. He has published: 'Essentials of Method'; 'Herbart and Herbartians'; 'Language Lessons.'

**Degas, dè-gā, Edgar Hilaire Germain,** zhār-mān, French painter and engraver: b. Paris 19 July 1834. He was a pupil of La Mothe, and studied at the Beaux Arts in Paris. He is one of the most interesting members of the impressionist school, having worked in pastel, etching, dry point, and stone-engraving, producing numerous interiors of theatres, and café-concerts, foyers of the opera, views of the circus and of laundries, studies of dancers, etc., and all with a masterly touch. He also produced several portraits of Manet.

**Degeneracy**, a term much in vogue at the present time to indicate certain physical and mental peculiarities found in some individuals who are unable to keep up in the struggle for existence according to more ethical and honest methods. That abnormalities in ethical and mental development are apt to be associated with abnormalities in the human frame, is the central assumption on which this hypothesis rests, and in recent years the school of Lombroso in Italy, and its followers elsewhere, have developed a very one-sided series of studies on this general thesis. Thus the argument would read that, given 100 epileptics, it will be found that they show a very high percentage of physical anomalies in the way of variations in the configuration of the ear, modifications of the so-called normal palate, differences in the lengths of the arms and legs, changes in the color of the iris, and other physical anomalies. Like inferences are drawn from the study of idiots, defectives, the insane and criminal classes, and an entirely new school of criminology has been based upon the anthropometric rules of Lombroso. In the present discussion the word degeneracy is restricted to include only certain border-line conditions. In cases of frank idiocy, epilepsy, and insanity, sufficiently comprehensive terms are at hand to describe the conditions, whereas the term degeneracy is by modern students best reserved for those individuals in whom the ethical and moral developments show a non-normal character. It is therefore in the fields of criminology and abnormal psychology that the term has its deepest and widest application. The relationship of genius to degeneracy is much played upon by superficial writers. The term is an unfortunate one in large measure, as it offers an easy and convenient means of designation for a large and unsorted group of phenomena that are very imperfectly understood even by the most searching scholars.

**Degeneration (in Pathology).** In medical pathology degeneration is one of the processes that occur in the cells of an organ whereby different grades of disintegration and shrinking take place. It is one of the retrograde or breaking-down processes in contrast to those of abnormal growth and increase, although in many of the degenerations both processes are going on side by side. When abnormal intracellular metabolism slowly converts the cell plasma into useless and abnormal substances the process is known as degeneration, and then following upon such degenerations there usually results a par-

tial or complete death of the plasma, leading to the destruction of the cell. In large measure, according to the character of the substances produced in the degenerative processes, various forms of degeneration are known. If in the organs there is a deposit of a waxy or lardy substance derived from the serum of the blood, the degeneration is known as amyloid degeneration. This is very frequently found in several organs at the same time, and results in large part from the infectious diseases accompanied by nutritional disturbances. Thus, in connection with chronic tuberculosis, syphilis, and chronic dysentery, amyloid degeneration is apt to occur. Hyaline degeneration is another form, which takes place in the connective tissue by which that type of cell is rendered homogeneous. Hyaline degeneration commonly occurs in the arteries and heart-valves, and is frequently associated with chalky infiltrations in these structures. Colloid degeneration occurs in certain forms of cancer in which the substance in the cells resembles softened glue. Mucous degeneration consists in the transformation of the leading tissues into a transparent, viscid, homogeneous mass consisting of mucins and pseudomucins. Mucoïd degeneration takes place largely in the connective tissue in the epithelial cells, and sometimes as a result of the disturbance of the functions of the thyroid gland as in myxædema. Fatty degeneration is a degeneration in which fat globules are deposited in the cells. Albuminous degeneration, or cloudy swelling, as it is sometimes called, consists in a fine granulation of a number of cells in the body, particularly in the kidneys, liver, and brain. This acute degeneration is very frequently associated with fatty degeneration, and is due in great part to anomalies of nutrition largely produced by bacteriological agencies, as in the infectious diseases, and also at times to auto-intoxic products having their origin within the body itself as a result of perverted oxidation. Pigmentary degeneration is another form, in which are deposited in the cells small or large quantities of iron compounds derived largely from the blood and known as pigments. Consult: Hektoen, 'Text-book of Pathology.'

**Degeneration**, a work of Max Nordau (1895), which aimed at a scientific criticism of those degenerates not upon the acknowledged lists of the criminal classes. "Degenerates," asserted Nordau, "are not always criminals, prostitutes, anarchists, and pronounced lunatics; they are often authors and artists. These, however, manifest the same mental characteristics, and for the most part the same somatic features, as the members of the above-mentioned anthropological family, who satisfy their unhealthy impulses with the knife of the assassin or the bomb of the dynamiter, instead of with pen and pencil. . . . Now I have undertaken the work of investigating the tendencies of the fashions in art and literature; of proving that they have their source in the degeneracy of their authors, and that the enthusiasm of their admirers is for manifestations of more or less pronounced moral insanity and dementia."

**Degeneration as a Factor in Evolution.** Degeneration, in biology, is a term used to describe those not unfrequent cases where an entire organism falls below the structural level of its young stages, or where an organ in the



same way loses its fullness of function, and becomes more or less atrophied, abortive, and simplified. Thus many parasitic worms, crustaceans, etc., are emphatically simpler than their free-swimming larvæ, and the sessile adult ascidian shows only traces of the vertebrate characters which are plain enough in the active young. Thus too, a crustacean which starts with a well-developed eye, may exhibit the gradual loss of this on assuming a dark habitat. The term is best confined to cases where a level of structure exhibited during early life is more or less lost in the adult. Degeneration must be distinguished (1) from occasional abortion; (2) from reversion to an ancestral type; and (3) from the occurrence of rudimentary and undeveloped organs where a character possessed by ancestral types remains more or less undeveloped, or shows itself only in embryonic life. Degeneration may be due to the environment, or to cessation of function, or to some more subtle constitutional cause. Absence of food, heat, light, etc., may mean the absence of the necessary stimulus for the growth and maintenance of the organs; or superfluity of food may cause one system to preponderate over others. Nor can it be doubted that cessation of function checks the food-supply to a given organ, and in other ways helps to bring about its degeneration. But on the other hand, some less obvious cause — the fatigue of early life, a constitutional sluggishness, etc., may share in conditioning degeneration, as in the case of the majority of the *Tunicata*. Weismann and others, however, would explain degeneration by what they call the non-operation of natural selection. On this view, organs are not only developed but maintained by natural selection; and if it happen that an organ is no longer an advantage in this struggle for existence (for example, eyes in dark caves), then natural selection no longer maintains that organ, and it disappears in the course of generations. Weismann applies this ultra-Darwinian conception especially to cases which might be called non-development rather than actual degeneration — for example, to the slightly developed wings of the *Apteryx*. Most cases of degeneration properly so called appear hardly to require his subtle explanation, but find a sufficient one in the nature of the environment, in the effects of stopped function, and in the constitution of the organism. The theory of the degeneration of man from a high state has been superseded by the belief in a development from low savagery (see ANTHROPOLOGY; ARCHÆOLOGY). Consult: Lankester, 'Degeneration'; Weismann, 'Ueber den Rückschritt in der Natur'; Nordau, 'Degeneration.' See also ENVIRONMENT; EVOLUTION, etc.

**Deger**, dā-gēr, Ernst, German painter: b. Bockenem, Hanover, 15 April 1809; d. Düsseldorf 27 Jan. 1885. He was a pupil of Wach and Schadow, in Berlin and Düsseldorf, becoming a painter in oil and of frescoes, and giving much attention to the latter form of work. He decorated the chapel at Castle Stolzenfels for Frederick William IV. of Prussia, becoming in 1869 professor at the Düsseldorf Academy and member of the Berlin and Munich academies. Among his works are: 'Pieta' (1830); 'Bearing the Cross' (1832); 'Annunciation' (1834); 'Virgin Adoring Christ' (1836); 'Madonnas and Seven Scenes from the Life of Christ'

(1841-51), in St. Apollinaris' Chapel, Remagen; 'Adam and Eve' (1853), Raczynski Gallery, Berlin. His works are noted for vigor and finish. He was a leader of the so-called "Nazarean School."

**De Gérando**, Joseph Marie, zhō-zěf mā-rē dē zhā-rañ-dō, BARON, French philosopher and statesman: b. Lyons 29 Feb. 1772; d. Paris November 1842. On the siege of Lyons in 1793 he took up arms in its defense, and greatly distinguished himself by his bravery, but was subsequently obliged to flee. He returned to France on the proclamation of an amnesty, and joined a cavalry regiment. While in garrison at Colmar he composed an essay on the theme proposed by the French Institute, 'Quelle est l'Influence des Signes sur l'Art de Penser?' and gained the prize. In 1799 he took office under Lucien Bonaparte as minister of the interior, and became secretary-general of that department in 1804. In 1811 he was made a councillor of state, and in 1812 governor of Catalonia. In 1819 he commenced a course of lectures in the Faculté de Droit, in Paris, on public and administrative law, suspended in 1822, and resumed in 1828. He was raised to the peerage in 1837. De Gérando acquired great fame by his philosophical writings, in which he follows with some deviations the school of Condillac. His principal works are: 'Des Signes et de L'Art de Penser considérés dans leur Rapports Mutuels' (1800), an enlargement of the dissertation formerly written for the French Institute; 'De la Génération des Connaissances Humaines' (1802); 'Histoire comparée des Systèmes de Philosophie' (1804), completed after his death; 'Du perfectionnement Moral et de l'Education de Soi-même,' a treatise which gained the prize of the French Academy in 1825; 'De l'Education des Sourds-muets de Naissance' (1827); 'Institutes du Droit administratif Français, ou Eléments du Code administratif réunis et mis en ordre' (1829-45); 'De la Bienfaisance Publique' (1839).

**Deggendorf**, dēg'gēn-dōrf, Germany, a town of Lower Bavaria, near the Danube, 39 miles northwest of Passau. It has manufactures of paper, linen, woollens, stoneware, and matches. Its Church of the Holy Sepulchre is visited annually by a large number of pilgrims. Pop. (1900) 6,843.

**Deglutition**, the physiological act of swallowing, or the process by which food is conveyed to the stomach.

**Degradation** of clerics in the Roman Catholic Church has two degrees, being either "verbal" or "actual." By "actual" degradation the offender, besides being deposed from the ministry, is deprived of his order and of the canonical privileges attached to his order, and in particular is delivered over to the secular arm for punishment; nor does any one who makes a violent assault on him incur the excommunication decreed against whoever violently attacks a cleric or a monk. By "verbal" degradation the cleric is deprived of all his clerical functions and stripped of his Church benefice if he holds any; but he retains the privileges of his order, and is not handed over to the secular power: he has right of appeal to ecclesiastical courts. If his offense merits imprisonment he must be shut up in some monastery or other ecclesiastical establishment; and though he is degraded, still were one to make



an assault on him the assailant would, *ipso facto*, incur excommunication. Nevertheless, since the sacrament of order imprints an indelible character, the degraded cleric, whether by actual or verbal degradation, is still priest or deacon or whatever he was before in the ministry; and his purely sacerdotal and sacramental acts, even his priestly absolution, if given *in articulo mortis* or in grave peril of death when no priest in full Church communion is at hand, is valid. So, too, his celebration of the mass is valid though sacrilegious.

The process of actual degradation is as follows: The culprit, in the attire of his order and bearing in his hands some instrument of his clerical functions, a chalice or a mass-book, is brought before the bishop. That emblem of his priestly state is taken away from him; then he is stripped of his ecclesiastical attire, and his head is shaven to obliterate the mark of the clerical tonsure. Finally the bishop addresses him in these words: "By the authority of God Almighty . . . we take away from thee the clerical habit and depose, degrade, and deprive thee of all order, benefice, and clerical privilege."

**De Grasse, Comte.** See GRASSE, COMTE DE.

**Degree**, in universities, a title and badge, accompanied with a certificate, conferred on the student, after examination, as a testimony of his proficiency in certain branches of knowledge, and entitling him to certain privileges. Some degrees are conferred, without previous examination, in general recognition of the graduate's eminence in the literary, philosophical, or scientific world. These are called honorary degrees. The degrees are much the same in all universities; but the regulations regarding them, and the previous discipline or studies, differ. The original degrees are bachelor, master, and doctor, to which many modifying characters are added, according to the faculties of arts, law, divinity, medicine, science, literature, etc., in which each degree is taken.

In music, a step ascending or descending the tone-ladder. It may consist of a semi-tone, a tone, or (in the minor scale) of an augmented tone. When the notes are on the same line or in the same space, they are of the same degree. The interval of a second is one degree, the interval of a third two degrees, and so on, irrespective of the steps being tones or semitones. Hence, also, notes are in the same degree whether they are natural, flat, or sharp, of the same note, as C and C sharp, E and E flat; and they are in different degrees when, though the same note on an instrument of fixed intonation, they are called by different names, as F sharp and G flat, C sharp and D flat.

In mathematics, a unit in a scale of measurement; specifically, in algebra, the amount reached by adding together the exponents of the facient or variables contained in any single term of an equation or expression; and in trigonometry, the unit of measurement for circles, or the angles they subtend.

**Degree.** See ANGLE; CIRCLE.

**Degrees of Latitude and Longitude.**

Degree of latitude is the space or distance on the meridian through which an observer must move to vary his latitude by  $1^{\circ}$ , or to increase or diminish the distance of a star from the

zenith by  $1^{\circ}$ ; and which, on the supposition of the perfect sphericity of the earth, is the 360th part of the meridian.

Degree of longitude is the space between the two meridians that make an angle of  $1^{\circ}$  with each other at the poles, the quantity or length of which is variable, according to the latitude.

**Degrees, Measurement of.** After Newton had taught that the earth, on account of its motion round its axis, must be highest near the equator, and that the diameter of the equator must be longer, by one 230th part, than the diameter from pole to pole, the French wished to investigate the subject further by actual measurement. The measurement was begun with the result that the axis of the poles was found to be longer than a diameter of the equator, and that the earth was, in form, more like a lemon than an orange. For 40 years disputes were maintained on this point without settling the question; and at last the Academy of Sciences resolved, on the proposition of Condamine, to have a degree measured at the equator (the expedition went to South America in 1735), and one in Lapland (Kittis and Tornea being the extreme stations to which the expedition was sent in 1736). It was found that the northern degree was greater than that under the equator, and that Newton's conjecture was right. But the question still remained, How great is the flattening of our planet? The theory said one 230th part, if the earth had been in a perfectly liquid state when it began its rotation. The calculations, however, always gave different results, varying according to the different measurements adopted as the basis of them; for measurements had been made, not only in America and Lapland, but also in France, England, Hungary, and Italy. When the French established their new and admirable system of measures and weights upon the basis of the metre, which was to be the ten millionth part of the distance from the equator to the pole (3.2808992 English feet, or 39.37 inches), it was necessary to know with accuracy the circumference and the flattening of the earth. A measurement, therefore, took place in France, not of one degree, but of 10 degrees, from Dunkirk to Formentera, one of the Balearic Islands. In Sweden in 1802 the degree, which 80 years before had been measured by Maupertuis, was now measured again with better instruments, and thus the circumference and flattening of the earth were pretty well ascertained. After the Peace of Amiens the measurements of degrees just made in England, under Gen. Roy, by Lieut.-Col. Mudge, were connected with those in France; and thus an arc of 20 degrees, from the Balearic Islands over France and England, to the Orkneys, was measured, and the flattening of the earth calculated to be 1-304th (the most recent estimate being 1-292). In India, the measurement of a degree, begun by Lambton, was continued by Everest and completed by Walker. The measurement of an arc of  $25^{\circ} 20'$  from Hammerfest to Ismailia was completed in 1855. Similar measurements have been continued to the present time, and at the Geodetic Congress in London in 1900, it was announced that English experts were engaged in measuring an arc of the meridian of  $104^{\circ}$  from Cape Colony to Alexandria, and had made considerable progress.

The annexed table shows the lengths of a degree of longitude for places at every degree of latitude from 0° to 90°. It is computed on the supposition that the earth is a sphere.

Deg. lat.	Eng. miles	Deg. lat.	Eng. miles	Deg. lat.	Eng. miles
0	69.07	31	59.13	61	33.45
1	69.06	32	58.51	62	32.40
2	69.03	33	57.87	63	31.33
3	68.97	34	57.20	64	30.24
4	68.90	35	56.51	65	29.15
5	68.81	36	55.81	66	28.06
6	68.62	37	55.10	67	26.96
7	68.48	38	54.37	68	25.85
8	68.31	39	53.62	69	24.73
9	68.15	40	52.85	70	23.60
10	67.95	41	52.07	71	22.47
11	67.73	42	51.27	72	21.32
12	67.48	43	50.46	73	20.17
13	67.21	44	49.63	74	19.02
14	66.95	45	48.78	75	17.86
15	66.65	46	47.93	76	16.70
16	66.31	47	47.06	77	15.52
17	65.98	48	46.16	78	14.35
18	65.62	49	45.26	79	13.17
19	65.24	50	44.35	80	11.98
20	64.84	51	43.42	81	10.79
21	64.42	52	42.48	82	9.59
22	63.97	53	41.53	83	8.41
23	63.51	54	40.56	84	7.21
24	63.03	55	39.58	85	6.00
25	62.53	56	38.58	86	4.81
26	62.02	57	37.58	87	3.61
27	61.48	58	36.57	88	2.41
28	60.93	59	35.54	89	1.21
29	60.35	60	34.50	90	0.00
30	59.75				

#### *Measurement of a Degree of Longitude.*—

The degrees of longitude are largest under the equator, and diminish continually toward the pole. Under the equator a degree of longitude contains 60 geographical, 69.16 statute miles. If the form of the earth is not entirely regular, the degrees of longitude on the same parallel of latitude cannot all be of the same length; and it has been proposed to investigate this by actual measurement. This task is, in the trigonometric part, as easy as the measurement of a degree of latitude; but in the astronomical part it is 15 times more difficult. The difference of the longitude of two places is determined by the difference of the hour of the day at the same point of time in the two; as a place situated 15 degrees to the east of another has noon a whole hour earlier. One hour, therefore, corresponds to 15 degrees, or 1,042½ statute miles, under the equator, or 5,504,400 feet; a minute of time to 91,740 feet, and a second of time to 1,529 feet. A mistake of a second of time, therefore, in calculating the longitude of two places, makes a corresponding error in space. To determine time within two or three seconds, by means of rockets, at a distance of 1,042½ miles is impossible; and while the measurement of an arc corresponding to this distance trigonometrically, may be attended with an error to the amount of 200 feet, an astronomical measurement would leave an uncertainty of 2,000 feet. The earlier measurements of the French were directed, in the north, by Maupertuis; in the south by Bouguer. Since that time measurements have been made in all the great continents of the globe—in Pennsylvania, in the time of Maskelyne, by Mason and Dixon; at the Cape of Good Hope by Lacaille, completed by Maclear; in Prussia by Bessel; in Russia by Struve; in Denmark by

Schumacher; and in England by Roy Kater, and Colby. The French arc from Formentara to Dunkirk was measured by Mechain and Delambre. The results of the measurements, as given by Airy, make the equatorial diameter 7925.648, and the polar diameter 7899.170 miles. Bessel's results are almost identical, namely, equatorial diameter 7925.604, and polar diameter 7899.114 miles. There is an international association, having as its main object the correlation of all degree measurements and connected data with the view of accurately ascertaining the figure of the earth.

**De Haas, dé hās, Maurice Frederick Hendrick,** American marine painter: b. Rotterdam 12 Dec. 1832; d. 23 Nov. 1895. He studied in England and at The Hague under Louis Meyer, and in 1857 was appointed painter to the Dutch navy. In 1859 he came to the United States and opened a studio in New York which remained his home henceforth. Among his paintings are: 'Admiral Farragut's Fleet passing New Orleans'; 'Coast of France'; 'Sunset at Sea'; 'Moonlight at Sea'; 'Sunset at Pigeon Cove'; 'Sunrise in a Fog at Newport'; 'Shipwreck'; 'Menhaden Boats off Long Island'; and 'Off Marblehead.'

**De Haven, Edwin J.,** American naval officer and explorer: b. Philadelphia 1819; d. there 2 Oct. 1865. He entered the navy in his 10th year and resigned in 1857. He commanded the expedition which left New York in 1850 to search for Sir John Franklin.

**Dehorning,** the act or practice of depriving animals, specifically cattle, of their horns. Clippers or shears have been invented for the operation, wherewith it is performed quickly and with comparatively little pain, and scarcely any disturbance of the animal's normal functions or condition. The most favorable conditions of weather, etc., should be chosen for it, and the aid of a skilful operator is desirable. When all features of cruelty or unnecessary pain are avoided, there is believed to be much to justify the practice of dehorning, inasmuch as it tends, among other benefits, to convenience, safety, and comfort in the handling of cattle, especially during their transportation from place to place.

**Dehra Dun, dēh'rā doon.** 1. A district in the Northwest Provinces, British India. It lies at the base of the Himalayas. Good roads, cultivated fields, hedges, streams flowing through meadows all, in parts of this district, look like some of the old country districts of the well-cultivated parts of Europe. The area is 1,193 square miles; pop. 170,252. 2. Dehra is the name of the chief town or capital of the district. It has an English garrison and contains a number of European inhabitants. Pop. 27,813.

**Dei Gratia, dē-i grā'shī-a** (Lat. "by the grace of God"), a formula which many European sovereigns add to their title, and which is taken from an expression of the apostle Paul in the New Testament. It was first used by the clergy in the time of Constantine the Great, as an expression of dependence upon the grace of God; and afterward the higher clergy came to use along with it the addition *et apostolica sedis* (by the grace of God and the apostolic see). In the time of the Carolingian race the secular princes also assumed it; and in course of time it came to be regarded as asserting something

like the divine right of kings and their independence of any earthly power. The expression has been made use of on the coins of many nations.

**Deiamba**, *dā-yām'ba*, Congo tobacco, a plant growing wild in the marshy districts of Congo, Africa, the flowers of which produce a narcotic effect when smoked.

**Deianira**. See *DEJANIRA*.

**Deidamia** (*Deidameia*), daughter of Lycomedes: she bore Pyrrhus and Oneirus to Achilles, during his abode at Scyros.

**Deiler, John Hanno**, American educator: b. Altoetting, Upper Bavaria, Germany, 8 Aug. 1849. He was graduated at the Royal Normal College, Freising, and studied at the Royal Polytechnic Institute, Munich. He taught in the public schools of Munich until 1871, and was principal of a German school in New Orleans 1872-9. He has been professor of German in the University of Louisiana and Tulane University since 1879. He has been connected with various German societies in New Orleans, and has published 'Das Redemptions-System im Staat Louisiana'; 'Geschichte der Deutschen Kirchengemeinden im Staat Louisiana'; 'Geschichte der Einwanderung von 1820-1896'; 'Deutschen Gesellschaften von New Orleans'; etc.

**Deimos** (*dī'mōs*) and **Phobos**, the names respectively of the outer and inner satellites of Mars, discovered by Prof. Asaph Hall in the summer of 1877, with the 26-inch equatorial of the Washington Observatory. Deimos revolves about its primary in 30 hours and 18 minutes, while Phobos, a most extraordinary body, accomplishes its revolution in 7 hours, 39 minutes, and 14 seconds, being at a distance of only about 3,700 miles from the surface of Mars.

**Deioces**, *dē-i'ō-sēz*, Median king: fl. about seven centuries B.C. He rose from a private station to be the founder of the Median empire. By acting as arbitrator in the disputes which took place in his own vicinity, he had acquired a high reputation for wisdom and justice; and when the Medes, in consequence of their revolt from the Assyrians, stood in need of a sovereign, they found none whose claims to the honor seemed stronger than those of Deioces. Immediately after his election he assumed great state, surrounded himself with body-guards, and built the city of Ecbatana, in the centre of which he resided, almost wholly hidden from public view, transacting all business by deputies. His administration was vigorous, and after a peaceful reign of 35 years he was able to transmit the throne, without a contest, to his son Phraortes.

**Deiotarus**, *dē-i'ō'tā-rus*, Galatian tetrarch: d. 30 B.C. He received from the Roman senate the title of king of that province and Armenia Minor, on account of services rendered to the Romans in the Asiatic wars. In the civil war he joined the party of Pompey. Cæsar took from him Armenia, obliged him to march with him against Pharnaces, and left him nothing but the title of royalty. He was accused of having plotted against the life of Cæsar, from which charge Cicero defended him in an oration yet extant. After the murder of Cæsar he returned to his dominions, joined Brutus, and afterward Augustus.

**Deiphobus**, *dē-ī'f'ō-būs*, in Greek legend the son of Priam and Hecuba, who married

Helen after the death of Paris, but was betrayed by her to the Greeks.

**Deiphon**, *dē'i-fōn*, in mythology, the son of Triptolemus and Mcganira, whom Ceres loved so passionately that she wanted to make him immortal, and made him pass through fire for that purpose. Being disturbed by the cries of his mother, who chanced to see the matter, the goddess in a hurry mounted her car, and left Deiphon to perish in the flames.

**Deipnosophist**, *dē-īp-nos'ō-fist* (from the Greek *Deipnosophistæ*, learned men at dinner), one of an ancient sect of philosophers famed for their learned conversation at meals. The work or rather compilation, 'Deipnosophistæ' of the celebrated Greek grammarian and rhetorician, Athenæus, who flourished about two centuries before Christ, has preserved to posterity thousands of quotations and names of authors to the number of 700, that otherwise would have been lost. The "learned guests" in his voluminous work numbered 29, who meet and banquet for days, entertaining one another with excerpts which Athenæus must have gathered at great pains and labor from the library of Alexandria, afterward destroyed. The titles of books he puts into the mouths of his characters alone number 2,500.

**Deir el-Baheri**, *dār-ēl-bāh'rē*, or **Der el-Bachri**, is a temple seat in the district of Thebes, on the west bank of the Nile, opposite Karnak, which is about five kilometres distance from it. At Der el-Bachri are some remarkable ruins of a temple built on terraces up the hillside which edges the alluvial plain. This is known as the temple of Queen Ratasu. The building is probably contemporary with those of Luxor and Karnak, being erected in the same style of magnificence.

**Deir-el-komar**, *kā'mār* ("convent of the moon"), a town of Syria, formerly the capital of the Druses, 13 miles south-southeast of Beyrout. It is situated on the edge of a deep and picturesque glen of Mount Lebanon, on the opposite side of which stands the palace Bteddin, the summer residence of the Christian governor of Lebanon. The town's chief industry is the making of embroideries and rich stuffs. Pop. 8,000, mostly Maronites.

**Deira**, *dē'i-rā*, an ancient Anglian kingdom stretching from the Tees to the Humber, and extending inland to the borders of the British realm of Strathclyde. With Bernicia it formed the kingdom of Northumbria. The union between Bernicia and Deira seems to have been rather unstable, for it was only under Edwin, Oswin, and other strong kings, either of Deiran or Bernician blood, that a real united Northumbria existed; and when the struggle for supremacy among the English kingdoms resulted in the triumph of Wessex, the two northern kingdoms were allotted to separate earls. Finally Deira became a kingdom under the Danes. The story seems to be authentic, that the slaves who attracted Gregory I. in the slave market of Rome, were from Deira.

**Deism** (Lat. *deus*, God), a philosophical system which, as opposed to Atheism (Gr. *a*, not, and *Theos*, God), recognizes a great First Cause; as opposed to Pantheism (Gr. *pan*, all, *Theos*), a Supreme Being distinct from nature or the universe; while as opposed to Theism, it

looks upon God as wholly apart from the concerns of this world. It thus implies a disbelief in revelation, as set forth in the Old and New Testaments, scepticism as regards the value of miraculous evidence, and an assumption that the existence of Deity can be proved by natural reason alone, unaided by spiritual or religious intuition. While Deism cannot be attributed to any one country or epoch, it seemed to have its fountain-head in England during the end of the 17th and first half of the 18th centuries.

**Deissman**, dis'män, **Adolf**, German theologian: b. Langenscheid, 7 Nov. 1866. He was educated at Tübingen and Berlin, and has been professor of New Testament exegesis and criticism at the University of Heidelberg from 1897. He has published 'Johann Kepler und die Bibel' (1894); 'Bibelstudien' (1895); 'Neue Bibelstudien' (1897); 'Theologie und Kirche' (1900).

**Deist**, one who admits the being of a God, but denies the existence or even necessity of a divine revelation, believing that the light of nature and reason are sufficient guides in doctrine and practice; a believer in natural religion only; a freethinker.

Etymologically the words deist and theist are the same in meaning, only deist is from Latin and theist from Greek. Conventionally, however, they are widely different in import; the term theist being applied to any believer in God, whether that believer be a Christian, a Jew, a Mohammedan, etc., or a deist properly so called. A deist is, as the definition states, one who believes in God, but disbelieves in Christianity, or more generally in revelation.

The term Deists, or Freethinkers, is usually employed to designate a series of writers who appeared in England in the 17th and 18th centuries, and sought to establish Natural Religion upon the basis of reason and free inquiry, in opposition to all positive religions, and without reference to supernatural revelation. They were critical, if not hostile, in their attitude toward Scripture.

**Deistic**, or **Deistical**, pertaining to deism or the deists, containing the doctrines of deism or Natural Religion.

Also a term applied to a controversy which arose in England in the 17th and 18th centuries, between those who believed and those who disbelieved in revelation; the latter, however, not occupying the atheistic standpoint, but accepting as a settled point belief in a personal God. The first, in point of time, of the celebrated English deists was Lord Herbert of Cherbury, the publication of whose work, 'De Veritate,' which appeared in Paris in 1624, began the controversy. There followed, on the same side, Hobbes, Tindal, Morgan, Toland, Bolingbroke, Paine, and others. The standard work on the subject is the Rev. Dr. John Leland's 'Deistical Writers,' first published in 1754.

**Dejanira**, děj-a-n'ra, in Greek mythology, a daughter of Æneus, king of Ætolia. Her father promised to give her in marriage to him only who proved to be the strongest of all his competitors. Hercules obtained the prize, and married Dejanira, by whom he had three children. When Nessus, a centaur, who had offered violence to Dejanira, was dying by a poisoned arrow shot from the bow of Hercules, she accepted from him the present of his tunic, which Nessus said had the power of reclaiming a

husband from unlawful loves. Accordingly, when Hercules became enamored of Iola, daughter of the king of Echalía, she sent him the centaur's tunic, which instantly caused his death. Dejanira was so disconsolate at this event that she destroyed herself.

**Déjazet**, dā-zhā-zā, **Pauline Virginie**, French actress: b. Paris 30 Aug. 1797; d. 1 Dec. 1875. On the stage before she was five years old, she grew up playing children's and boys' roles with marvelous precocity of intelligence and grace. In 1821 she began to play at the Gymnase, but her greatest triumphs were won at the Théâtre du Palais-Royal, whither she betook herself in 1834. She left the boards in 1868, and the next year received a pension of 2,000 francs. See 'Lives,' by Lecomte (1866), Duval (1876).

**De Kalb**, Johann, yō'hän də kälb, French soldier: b. Huttendorf, Bavaria, 29 June 1721; d. Camden, S. C., 19 Aug. 1780. He was educated in the art of war in the French army. In 1762 he visited the Anglo-American colonies as a secret agent of the French government. He was a brigadier in the French service, when, 7 Nov. 1776, he made with Franklin and Silas Deane an engagement to serve in the forces of the revolted colonies; and in 1777 he accompanied Lafayette to America. Congress appointed him a major-general 15 Sept. 1777, after which he joined the main army under Washington, and was active in the events near Philadelphia, which preceded the encampment at Valley Forge. He served in New Jersey and Maryland till, in April 1780, he was sent to reinforce Gen. Lincoln, then besieged in Charleston. He was second in command under Gen. Gates; and in the disastrous battle of Camden, 16 Aug. 1780, was at the head of the Maryland and Delaware troops, who maintained their ground till Cornwallis concentrated his whole force upon them. He fell in the charge upon his regiments before they gave way. He died at Camden three days afterward, and a monument was erected there to his memory in 1825, Lafayette placing the corner-stone.

**De Kalb**, Ill., city in De Kalb County, on the Chicago & Northwestern Railroad, 60 miles west of Chicago. The industries of the city are the manufacture of wire and other iron products, glove and shoe manufacturing and agricultural machinery. De Kalb has 3 banks with a combined capital of \$350,000. The city is governed by a mayor and council of 10 members, elected for two years, and owns its own water-plant. The Northern Illinois State Normal School is located here. Pop. (1904) 6,000.

**De Kay**, Charles, American poet, grandson of Joseph Rodman Drake: b. Washington, D. C., 25 July 1848. He was educated at Yale and has been for many years the literary and art editor of the *New York Times*. His poems are mostly founded on themes from Oriental, classical and literary history. Among his works are: 'The Bohemian' (1878); 'Hesperus and Other Poems' (1880); 'The Vision of Nimrod' (1881); 'The Vision of Esther' (1882); 'The Love Poems of Louis Barnaval, by Charles De Kay' (1883).

**Deken**, dā'kēn, **Agathe**, Dutch author: b. Amstelveen, near Amsterdam, 14 Nov. 1741; d. 14 Nov. 1804. She wrote a number of novels

with her friend Elizabeth Bekker (q.v.) and poems, among them 'Lideren voor den Boerensland' and 'Lideren voor Kinderen.'

**Dekker, Eduard Douwes**, ɛd'oo-ārd doo'-vės dēk'kēr, Dutch novelist, pseudonym 'MULTATULI'; b. Amsterdam 2 March 1820; d. Nieder-Ingelheim 19 Feb. 1887. He spent several years in government service in the Dutch East Indies. His story, 'Max Havelaar' (1860), is a shocking accusation of wrongs and scandals against the Dutch administration of Java. He later published many satirical works on social, political, and philosophical questions, among them a volume of admirable 'Parables'; a novel, 'The Blessed Virgin'; a drama, and 'The School of Princes.'

**Dekker, or Decker, Jeremias de**, Dutch poet: b. Dort 1609 or 1610; d. Amsterdam 1666. His first published poetical work was 'The Lamentations of Jeremiah'; and several others which soon followed it were also translations. His 'Love of Gold,' a powerful satire, and his 'Goede Vrijdag,' or the 'Passion of Christ,' as well as his lyric poems, are still in high estimation; and his 'Epigrams' (Punt-dichten) are, beyond dispute, the best of the kind which the literature of that period produced. The best edition of his poems, accompanied with a biography, was published by Brouerius van Nideck (1726).

**Dekker, or Decker, Thomas**, English dramatist: b. London about 1570; d. after 1637. He is first mentioned as a theatrical writer in 1597. He was one of the literary antagonists of Ben Jonson, who satirized Dekker in his 'Poetaster,' and the latter took his revenge in his 'Satiromastix.' He appears to have lived from hand to mouth, and been often in difficulties, imprisonments for debt being almost the only record, besides his works, that is left of him. Among his writings may be mentioned the 'Seven Deadly Sinnes of London,' a moral tract; the 'Double P P,' a violent tract against the Catholics; 'A Knight's Conjuring,' in which he introduces Chaucer, Spenser, and many other dead poets; 'The Gull's Hornbook,' valuable as a picture of the time. Besides his own plays he co-operated with Massinger in the 'Virgin Martyr,' and with Ford in the 'Sun's Darling,' a moral masque; the 'Pleasant Comedie of Old Fortunatus' (1600); and 'The Honest Whore' (1604); are among the most esteemed of his dramas. The number of Dekker's plays is about 28, of his tracts about 25.

**De Ko'ven, Anna Farwell**, American novelist: b. 19 Nov. 1860. She was graduated at Lake Forest University in 1880, and married to Louis Reginald De Koven (q.v.) May 1884. She is the author of 'A Sawdust Doll' (1894); 'An Iceland Fisherman,' a translation from Pierre Loti (1889); 'By the Waters of Babylon' (1901).

**De Koven, Henry Louis Reginald**, American composer: b. Middletown, Conn., 3 April 1859. He was graduated at Oxford in 1879 and studied music in the leading cities of Europe. His operettas have had great success, notably: 'The Begum'; 'Don Quixote'; 'Robin Hood'; 'The Fencing Master'; 'The Three Dragoons'; 'Maid Marian'; etc.

**De Koven, James**, American Episcopal clergyman and educator: b. Middletown, Conn.,

19 Sept. 1831; d. Racine, Wis., 19 March 1879. He was educated at Columbia College and at the General Theological Seminary in New York. After his ordination to the priesthood in 1855, he took a pastoral charge at Delafield, Wis., and at the same time became principal of the preparatory school for Nashotah Seminary, founded two years earlier. In 1859 this became Racine College, and De Koven its first warden. He soon acquired a marked influence throughout the West, both in educational and ecclesiastical matters, in the latter taking up and carrying forward the teachings of the Oxford Movement. His most prominent appearance in this connection was in the General Convention of 1871, at a time when the ritual controversy ran very high. In bold and outspoken terms, which have become historical, he proclaimed and defended his position, with a marked effect on the legislation under discussion. When, however, in 1875, he was elected Bishop of Illinois, a considerable majority of the standing committees of the other dioceses refused to confirm his election, regarding his views as dangerous. He labored diligently for the upbuilding of Racine College, where he remained until his death. The published volume of his sermons (1880) contains a preface by Mr. Dix, which gives some idea of his commanding position in the church life of his time.

**De Kroyft, dē kroift, Susan Helen**, American author: b. Rochester, N. Y., 29 Oct. 1818. She was graduated at Lima College, New York, 1843, and married Dr. William De Kroyft, of Rochester, who was killed on his wedding day by a fall from a carriage. Mrs. De Kroyft shortly afterward lost her sight and has since then remained blind. Among her works are: 'Little Jakey' (1871); 'Darwin and Moses,' a lecture; 'A Place in Thy Memory' (1849); and 'Mortara.'

**Del Credere, dēl krēd'ē-rē**, an Italian mercantile phrase expressing a guarantee or warranty, given by factors, brokers, or mercantile agents, who, for an additional commission, become bound not only to transact business for their employers, but also to guarantee the solvency of the persons to whom the goods are sold, or with whom business is done. This additional commission is known as a *del credere* commission. The term has come into general use in international commerce, and is recognized in the common law system of England and America.

**De la Beche, dē lā bāsh, Sir Henry Thomas**, English geologist: b. near London 1796; d. there 13 April 1855. In 1817 he became a Fellow of the Geological Society, of which he was afterward made secretary, and eventually president in 1847. Among his works are a 'Manual of Geology' (1831); 'Researches in Theoretical Geology' (1834); and a 'Geological Observer' (1853). He was founder of the Geological Museum and of the School of Mines. In 1848 he received the honor of knighthood.

**Delaborde, Henri François, ɔn-rē frānswā dē lā-bōrd**, Count, French general: b. Dijon 21 Dec. 1764; d. 3 Feb. 1833. He distinguished himself in the Republican armies; fought through the whole of the Napoleonic wars, and was ennobled in 1807.

**Delacroix, Ferdinand Victor Eugène, fēr-dē-nāi vėk-tōr ɛ-zhān dē-lā-krwā**, French painter: b. Charenton-St.-Maurice, near Paris,



26 April 1799; d. Paris 13 Aug. 1863. His first painting, 'Dante and Virgil in the Infernal Regions,' attracted much notice in the exhibition of 1822. This picture displayed a wide departure from the coloring and manner of the school of David, and accordingly it gave rise to enthusiastic praise on the one side; on the other to contemptuous depreciation, but everywhere to wonder. His 'Massacre in Scio' (1824) was a formal declaration of war against the school of the classicists, who named it a Massacre of Painting. These were followed by the 'Execution of the Doge Marino Falieri' (1826); the 'Death of Sardanapalus' (1827); and the 'Murder of the Bishop of Liège' (1830)—pieces painted with fire and vigor. His sympathy with the revolutionary party was shown by his celebrated picture of the 'Goddess of Liberty at the Barricades.' In 1831 he joined the embassy sent by Louis Philippe to the Emperor of Morocco. To this journey we are indebted for several pictures remarkable for their vivid realization of Oriental life as well as their masterly coloring. They are the 'Jewish Marriage'; 'Muley Abderrhaman With His Body-guard'; 'Algerian Ladies in Their Chamber'; 'Moorish Soldiers at Exercise'; and the several scenes of common life. In spite of his undoubted genius Delacroix failed in gaining popularity with the general public. He was commissioned not only with the decoration of public buildings, such as the Luxembourg Palace, the town-hall, and the Louvre, but large paintings were executed by him for the Parisian churches, and the historical museum of Versailles contains two of his masterpieces—the 'Battle of Taillebourg' (1838), and the 'Taking of Constantinople by the Crusaders' (1841). In 1857 the Academy elected him a member of their body. Delacroix was an artist of great versatility; mythology, legend, history, and poetry by turns furnished him with subjects, and in addition he painted portraits, allegorical and genre pictures, hunting scenes, etc.; but all exhibit at once his strength and his weakness—brilliant coloring and incorrect drawing.

**Del'afield, Francis**, American physician: b. New York 3 Aug. 1841. He was educated at Yale, and the New York College of Physicians and Surgeons, in which latter institution he has since been a professor of pathology and practice of medicine. He has published 'Handbook of Pathological Anatomy'; 'Handbook of Post Mortem Examinations and Morbid Anatomy'; 'Studies in Pathological Anatomy.'

**Delafield, Richard**, American military engineer: b. New York 1 Sept. 1798; d. Washington, D. C., 5 Nov. 1873. He graduated from West Point in 1818, and was draftsman to the American boundary commission, appointed under the treaty of Ghent. In 1819-38 he was assistant engineer in the construction of Forts Monroe and Calhoun; had charge of the improvements on the Mississippi, and of the building of the Cumberland road and the construction of Fort Delaware. In 1838 he was appointed superintendent of the Military Academy at West Point, and held the position seven years at that time, and again from 1856 to 1861, when he was relieved at his own request. In 1855 he was senior member of a commission sent to the Crimea to report on modern methods of warfare; he prepared the report which was published by Con-

gress in 1860. During the Civil War he assisted in organizing and equipping the New York troops and had charge of the construction of fortifications in New York harbor. In 1864 he was made chief of engineers, and retired in 1866 with the rank of major-general.

**Delago'a Bay**, a bay on the southeast coast of Africa, in Portuguese territory, partly enclosed by Inyack peninsula. It is about 70 miles long and 20 miles wide. Though crossed at its entrance by a shifting bar it is accessible to vessels of the largest class, and is the finest harbor on the east coast of Africa. Several large rivers flow into it. See PORTUGUESE POSSESSIONS IN AFRICA.

**De la Hire, Philippe**, fê-lêp dé là êr, French mathematician: b. Paris 18 March 1640; d. there 21 April 1718. He was a member of the Academy of Sciences and professor at the College of France. His chief work was in pure mathematics, but he was also an astronomer. Many of his papers are in the Memoirs of the Academy of Sciences. Among his writings are 'Nouvelle Méthode de Géométrie'; 'Sectiones Conicæ'; 'Mémoire sur la Epicycloïde' (1694); and 'Mémoire sur les Conchoïdes' (1708).

**Delambre, Jean Baptiste Joseph**, zhôn báp-têst zhô-zêf dé lân-br, French astronomer: b. Amiens, France, 19 Sept. 1749; d. Paris 19 Aug. 1822. In 1790, eight years after the discovery of Uranus, Delambre published the tables of that planet, although in that period it had but performed a small part of its eighty years' course. He also constructed tables of Jupiter and Saturn, and of the satellites of Jupiter, which, with several treatises, procured him a reception into the National Institute. In 1802 Napoleon appointed him inspecteur-général des études, which post he resigned when chosen perpetual secretary of the class of mathematical sciences (1803). His first tables of the sun were published in 1792; in 1806 appeared his new ones. In 1807 he succeeded Lalande in the Collège de France, and wrote his 'Traité d'Astronomie théorique et pratique' (1814); 'Histoire de l'Astronomie du moyen âge' (1819); 'Histoire de l'Astronomie moderne' (1821); 'Histoire de l'Astronomie du 18me Siècle.'

**Delamination.** See EMBRYOLOGY.

**De Lancey, Edward Floyd**, American historical writer: b. Mamaroneck, N. Y., 23 Oct. 1821. He is a son of W. H. De Lancey (q.v.). He is author of 'Documentary History of New York' (1851); 'The Capture of Fort Washington the Result of Treason' (1877); 'Origin and History of Manors in the Province of New York' (1866).

**De Lancey, William Heathcote**, American Protestant Episcopal bishop: b. Westchester County, N. Y., 8 Oct. 1797; d. 1865. He was graduated at Yale College in 1817; studied theology and entered the Episcopal ministry in 1822. He was secretary of the house of bishops in the general convention of the Episcopal Church of the United States 1823-9. Upon the reorganization of the University of Pennsylvania in 1828, he was chosen provost of that institution, and remained provost five years. In 1839 he became bishop of the diocese of Western New York.

**Deland, Ellen Douglas**, American writer for young people: b. Lake Mahopac, N. Y., 3



Sept. 1860. She was educated in New York but until very recent years has lived mainly in Philadelphia. Her published books include 'Oakleigh' (1896); 'Malvern' (1896); 'In the Old Herrick House' (1897); 'A Successful Venture' (1897); 'Alan Ransford' (1898); 'Katrina' (1898); 'Three Girls of Hazelmere' (1903).

**Deland, Margaret Wade Campbell**, American novelist: b. Allegheny, Pa., 23 Feb. 1857. She was educated at the Cooper Union, New York, and for a time taught drawing. In 1880 she married L. F. Deland and has since lived in Boston. 'John Ward, Preacher' (1888), her first novel, attracted wide notice. Other works are 'The Old Garden and Other Verses' (1887); 'Sydney' (1890); 'Florida Days,' a collection of sketches of travel; 'The Story of a Child' (1892); 'Mr. Tommy Dove and Other Stories' (1893); 'Philip and His Wife' (1894); 'The Wisdom of Fools' (1897); 'Old Chester Tales' (1901); 'Good for the Soul.'

**De Land, Fla.**, town, county-seat of Volusia County, on the Jacksonville, Tampa & Key West Railroad; about 55 miles southwest of Saint Augustine. It is a favorite health resort, noted for its sulphur springs. The John B. Stetson University, a Baptist institution, was established here in 1887. Pop. 1,510.

**Delane, John Thaddeus**, English journalist: b. London, 11 Oct. 1817; d. 22 Nov. 1879. After leaving Oxford he studied life in many forms, walked the hospitals, was called to the bar, and reported in the House of Commons. In May 1841 he became editor of the *London Times*. For 36 years Delane held this post. Under his editorship the *Times* attained a prodigious circulation, and an influence unparalleled in the history of journalism. He merged his personality in his paper, and the history of his later life is the history of the extraordinary influence wielded by the leading journal. He was singularly shrewd in weighing public opinion, possessed remarkable foresight, and seldom made a mistake. He resigned the editorship in 1877.

**De'ano, Columbus**, American lawyer and politician: b. Shoreham, Vt., 5 June 1809; d. Mount Vernon, Ohio, 23 Oct. 1896. He studied law at Mount Vernon, was admitted to the bar in 1831, and shortly after elected prosecuting attorney of the county. He was elected member of Congress in 1844 and voted against the declaration of war in Mexico; he was again elected to Congress in 1864 and 1866. He was delegate to the Republican conventions of 1860 and 1864, and member of the State Legislature in 1863. In President Grant's first administration he was appointed commissioner of internal revenue, and reorganized the department, putting it on an excellent financial footing. In 1870 he became secretary of the interior, resigning in 1875, and retiring from public life. He was one of the trustees of Kenyon College and endowed its preparatory department.

**Delany, Mary Granville**, English writer: b. Coulston, Wiltshire, 14 May 1700; d. Windsor 15 April 1788. She married first, in 1718, Alexander Pendarves (1659-1724); and secondly, in 1743, Swift's friend, the Rev. Patrick Delany (1685-1768). After his death she lived chiefly in London. Her much-admired "paper mosaics," or flower-work, have long since faded;

but she is remembered through her patronage of Miss Burney, and by her 'Autobiography and Correspondence' (1861-2), with its gossip of the court and the literary society of her day.

**Delaplanche, Eugène**, French sculptor: b. Paris 1836; d. there 1891. He was a pupil of Duret, received the grand prize of Rome, 1864, and the medal of honor 1878. Among his works are: 'Child and Turtle'; 'Eve Before the Fall'; 'Saint Agnes'; 'Maternal Education'; 'Harmony'; 'Africa,' in bronze; 'Music'; 'Virgin of the Lilies,' in the Luxembourg; 'Aurora,' also in the Luxembourg; 'Circe'; 'The Dance'; and a statue of 'Auber' for the opera house. He is noted for grace and nobility of treatment and refinement of style.

**De Lara, Isidore (COHEN)**, English composer: b. Dublin. He was a pupil of Muzucato in Milan, and gained great popularity in England by singing his own compositions, especially drawing-room songs. His opera 'Moina' was given at Monte Carlo in 1891, and his 'Amy Robsart,' with libretto by Augustus Harris, was produced at Covent Garden, London, in July 1893, but the music was not notable. The music of his 'Messaline' has been deemed lacking in originality. The libretto was by Armand Silvestre and Eugene Morand. This opera was produced at Monte Carlo 21 Feb. 1899; in London 1899 and 1900, with Calvé in the leading part, and in New York in 1902 with Calvé and Alvarez.

**De la Ramée, de lä rä mā, Louise.** See OUDA.

**De la Rey, Jacob Hendrick**, Boer general: b. Lichtenburg District of the Western Transvaal 1849. He gained distinction in his first command against the Basutos, when very young, and served two years in the Volksraad, supporting Joubert. He commanded the Lichtenburg burghers at the outbreak of the Boer-British war, 1899-1902, which force served later in Cronje's western column. He distinguished himself at Magersfontein; in the retreat before Lord Roberts, and at Nooitgedacht 1900, where he captured 500 English troops. He captured Lord Methuen 7 March 1902 with many of his men, but released him on account of not being able to treat his wounds, lacking hospital facilities; an instance of his noted humaneness. He was very popular with the Boers and his military skill was greatly respected by his foes. He served on the Boer committee which arranged for peace, and, later, on the deputation visiting Europe and the United States to raise funds for the Boers that they might continue their occupations at home.

**De la Rive, Auguste**, Swiss physicist: b. Geneva 9 Oct. 1801; d. Marseilles 28 Nov. 1873. He received the appointment to the chair of natural philosophy in the Academy at Geneva at the age of 22. First devoting himself to the study of the specific heat of gases, and of the observation of the temperature of the earth's crust, he soon turned his complete attention to electricity, making original discoveries in connection with magnetism, electrodynamics, the relation between magnetism and electricity, and the properties of the voltaic arc, and presenting new theories upon the subject of the aurora borealis. He discovered the process of electro-gilding, for which he received the grand prize of 2,000 francs from

the Académie of Sciences 1842, becoming one of the eight foreign associates of the Académie in 1864. His chief work was a complete treatise on electricity in three volumes, which was translated into several languages, and was considered of the highest authority upon the subject.

**Delaroché, Hippolyte**, ē-pō-lēt dē-lā-rōsh, (familiarily styled PAUL), French painter: b. Paris 17 July 1797; d. there 4 Nov. 1856. He entered the studio of Baron Gros, and rapidly rose to eminence as one of the greatest of modern painters in France. His subjects are principally taken from French and English history. Among others may be mentioned, 'St. Vincent de Paul Preaching before Louis XIII. on Behalf of Deserted Children'; 'Joan of Arc Interrogated in Prison by Cardinal Beaufort'; 'Flora Macdonald Ministering to the Pretender after the Battle of Culloden'; the 'Death of Queen Elizabeth,' a work greatly admired by French and generally reprobated by English critics; 'A Scene of the St. Bartholomew Massacre'; 'The Children of Edward IV. in the Tower'; 'Cardinal Richelieu conducting Cinq Mars and De Thou up the Rhone to Execution'; 'Cromwell Contemplating the Dead Body of Charles I.,' one of Delaroché's most exalted efforts; the 'Execution of Lady Jane Grey,' and the 'Death of the Duke of Guise.' What he considered his *chef-d'œuvre*, was the pictorial decoration of the hemicycle of the Palais des Beaux Arts, on which he was engaged from 1837 to 1841. In this composition Delaroché has sought to illustrate the history of art from the remotest period to the present day, by representing, in one compartment, the great artists of all ages, painters, sculptors, and architects. Notwithstanding the number of persons depicted (upward of 80), and the diversities of figure and costume, the whole presents a group in perfect harmony, with a coloring at the same time quiet and rich, and a correctness of drawing which leaves nothing to be desired. It has often been objected to Delaroché that the accessories of his pictures are finished with such minuteness as to divert the attention from the main subject. His signal merits consist in correct drawing, brilliant and harmonious color, and great distinctness and perspicuity in treatment, rendering the story of his pictures at once intelligible.

**De la Rue, Warren**, English inventor and physicist: b. Island of Guernsey 18 Jan. 1815; d. London 19 April 1889. He was educated in Paris and followed his father's business, that of manufacturing paper wares. For this he invented many new processes and machines. He is best known for his application of photography to astronomy. He was a member of the International Electrical Congress at Paris in 1861, president of the Royal Astronomical Society, and held other posts of honor. His reports of original observations in chemistry, astronomy, and physics are of the greatest value.

**Delaunay, Charles Eugène**, shārī ē-zhān dē-lō-nā, French astronomer: b. Lusigny, Aube, 9 April 1816; d. Cherbourg 5 Aug. 1872. He studied at the Ecole Polytechnique, becoming a mining engineer. He taught mechanical engineering at the Polytechnique and on the Faculty of Sciences of Paris, and was made a member of the Institute in 1855. In 1870 he succeeded Leverrier as director of the Observatory. Among

his works are: 'On a New Analytical Theory of the Movement of the Moon'; 'Theory of the Tides'; 'Slowing of the Rotation of the Earth'; 'The Seasons'; and a 'Report on the Progress of Astronomy' (1867).

**Delaunay, Jules Elie**, zhül ā-lē, French figure and portrait painter: b. Nantes 12 June 1828; d. Paris 5 Sept. 1891. He received the Grand Prix de Rome in 1856; the first-class medal at the Paris Exposition of 1878; and at that of 1889 was awarded the medal of honor. He was made an officer of the Legion of Honor and a member of the Institute. His portraits are considered masterpieces. His 'Diana' is in the Luxembourg Gallery, Paris, and the 'Death of the Centaur Nessus,' in the Museum at Nantes.

**Delaunay, Louis Arsène**, loo-e ār-sān, French actor: b. Paris 21 March 1826; d. Versailles 22 Sept. 1903. He made his début in Oct. 1846, at the Odéon. In 1848 he acted at the Théâtre Français in the role of Durante, becoming secretary to the theatre in 1850. Till he retired (1887), he was one of the most accomplished actors on the French stage. He has found some of his greatest parts in the plays of Hugo, Pailleron, De Musset, and Augiers.

**Delavan, Wis.**, a city of Walworth County near Delavan Lake, and on the Chicago, Milwaukee & St. Paul Railroad. It has some manufacturing interests, including dairies. It is the seat of the State institution for the education of the deaf; and on account of mineral springs in the vicinity and the lake is a place of summer resort and the site of a summer school. Pop. (1900) 2,244.

**Delavigne, Jean François Casimir**, zhōn frān-swā káz-ē-mēr dē-lā-vēn-yē, French poet and dramatist: b. Havre 4 April 1793; d. Montmorency 11 Dec. 1843. He was educated at the Lycée Napoléon, Paris, and in 1811 composed a dithyrambic on the birth of the King of Rome, which attracted considerable attention, and procured him, from Count François de Nantes, a situation in the office of indirect taxes. At the Restoration he published a set of elegies entitled 'The Messenians,' which deplored the faded glories of France. He produced in 1819 his tragedy of 'The Sicilian Vespers'; 'The Comedians' appeared in 1820, and the tragedy of 'The Paria' in 1821. Of his other plays which followed these may be mentioned: 'The School of Old Men'; 'Marino Faliero' (1829); 'Louis XI.,' founded on Commines' 'Memoirs'; 'Quentin Durward'; 'Don John of Austria.' His hymns, 'The Parisienne' and 'The Varsoviennne,' and the ballad 'The Toilette of Constance' are among his more popular poetical pieces. He became in 1825 a member of the Academy.

**Delaware** ("the Diamond State"), the smallest but one and the least populous of the 13 original States; southernmost of the Middle States; 96 miles long by 9 to 37 broad, 2,050 square miles in area, 1,960 square miles of land. It is bounded east by the Atlantic, Delaware Bay, and Delaware River, the latter separating it from New Jersey; north by Pennsylvania, the boundary being a semicircle struck 12 miles from New Castle court-house; west and south by Maryland, arbitrary lines at a right angle. The broadest part is about 25 miles of the

## DELAWARE

extreme south, whence it narrows almost regularly to the north. Capital, Dover, near the centre. Pop. (1903) about 190,000.

*Topography.*—The whole peninsula between Chesapeake Bay and the Delaware River estuary and bay, divided between Maryland and Delaware, is part of the Atlantic coastal plain; flat, sandy, and with frequent swamps, of which there is one of about 70 square miles in southern Delaware. North of New Castle, where the Pennsylvania uplands sink down to it, there is a handsome rolling country; and behind Wilmington, the divide between Brandywine and Christiana creeks becomes a ridge rising to a hill 280 feet high, the most elevated ground in the State, with pleasing scenery along the streams. South of this, a marshy and sandy ridge nowhere over 70 feet high runs through the State northwest to southeast, forming the watershed between the bays, but following the line of the Atlantic coast about a dozen miles inland. In the southwest, therefore, the part of the State west of the ridge is bulky enough to create some fair-sized creeks, all feeding the Nanticoke in Maryland. The other streams are all petty brooks except in the extreme north, where Brandywine and Christiana creeks flow southeast from Pennsylvania, unite a half mile from the Delaware, and form a deep-water estuary which constitutes Wilmington harbor, which contributes to the greatness of the city. The only other good harbors on this marshy coast are at New Castle and Lewes, the latter protected by the Delaware breakwater at Cape Henlopen. On the southeast coast are two considerable but shallow lagoons called Rehoboth Bay and Indian River Bay, communicating at the outer edge, and separated from the sea by a sandspit pierced by Indian River Inlet, through which and on them vessels under six feet draft can navigate. Delaware Bay itself has 35 to 75 feet of water in mid-channel.

*Natural Products.*—The State has three geological divisions: Cretaceous in the north, succeeded southward by Tertiary and post-Tertiary, or Alluvial. The most valuable minerals, naturally, are found in the upper levels in the north. Near Wilmington are granite quarries which turn out over \$600,000 of products a year; kaolin or porcelain clay beds, among the first worked in the United States, and which in 1900 produced 10,500 tons, valued at \$91,500; and other clays for brick and terra-cotta. There is found also glass sand, feldspar, shell marl in the greensand districts, and bog-iron ore in all the swamps. The natural woods of the State are valuable, but most of them have been cut away (including the white-oak for shipbuilding once plentiful) except the forests of cypress, hackmatack, and other evergreen in the swamps. There is much shooting of wild ducks and teal, wild geese, etc., and some terrapin are caught.

*Climate and Rainfall.*—Delaware naturally has a range of temperature intermediate between the severe extremes of New England and the heat of the South; and still further tempered by the sea breezes which alternate with the southwest winds in summer. The northwest winds of winter and spring are probably not more severe than of old, but the delicate crops, like peaches, have furnished a more costly thermometer, and the precariousness of the spring warmth is felt. On an average, the spring begins about 1 April, and the autumn

frosts toward the middle of October; the average temperatures run from about 85° in August to 25° in January. The rainfall is from 40 to 45 inches annually, the heaviest on the coast; and droughts never become ruinous. In the swampy districts and southern lowlands there is some malaria; but as a whole the State has a good sanitary record.

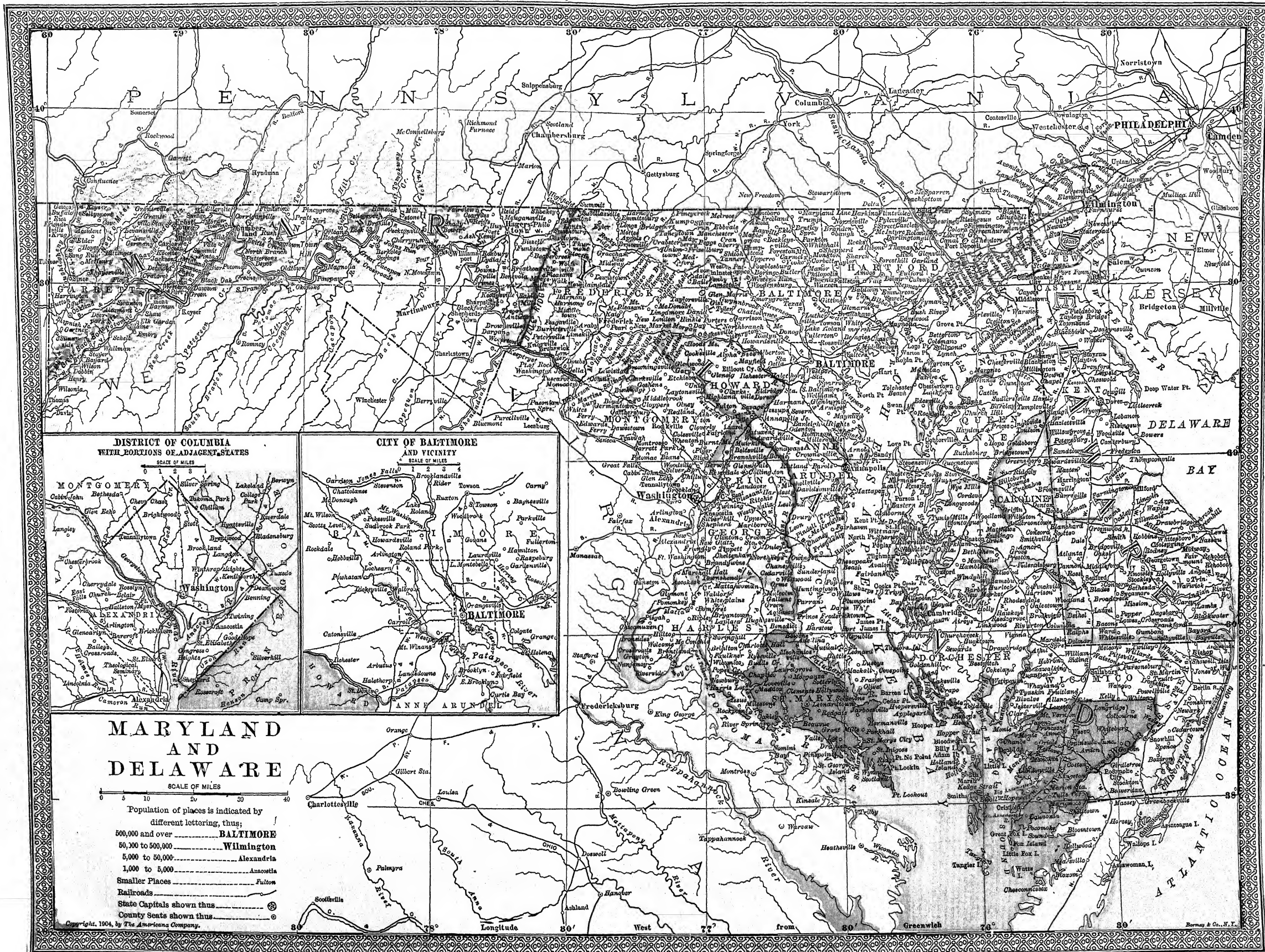
*Soils and Agriculture.*—The soil of the State steadily lightens southward from a heavy rich clay in the north, and for some miles inland along the Delaware River, to loamy clay and loam in the centre, and sand with some loam in the south. The north is the region of cereals and hay; the centre and south, of fruits, berries, grapes, and vegetables; and the south especially of peaches and strawberries. The State is one immense market garden and orchard for the North, especially the great cities not far away,—New York, Philadelphia, and Baltimore. New Jersey, Maryland, and Delaware raise three fourths of all the peaches, berries, and small fruits sold in these markets. Delaware in the popular mind is identified with the peach crop, which in good years has yielded 4,000,000 baskets or crates; but a considerable percentage of the trees have been injured and the crops frequently blasted by the late spring frosts in recent years, and there is a growing tendency to replace entire reliance on this precarious crop by market gardening and even cereals. Still, the railroad freightages in the summer of 1902 were estimated at 2,351,460 baskets, besides 362,345 baskets of pears. The other orchard fruits together exceed the peaches; the apple crop especially is very large. Of the market gardening, the tomato is by far the principal crop, and is exceeded only by that of Maryland and Indiana; 16,000 acres were planted in 1902, and 750,670 cases sent out, of 24 cans each, or 18,160,000 cans. A surprising development, however, in which it is alone among the eastern States, has been in the wheat crop for the past two decades: its acreage in 1900 was 118,740, or nearly one sixth of all the improved land, against 87,530 in 1880. In 1902 it raised 1,792,006 bushels. The first place in acreage, however, belongs to corn, 187,134 in 1902, or about one fourth of all; the yield was 5,239,732 bushels. Third was hay, 76,373 acres, 83,247 tons. There were also 6,000 acres of potatoes, with a yield of 471,000 bushels, or 78.5 bushels to the acre, against 48 in 1900. The dairy interest has enormously increased in the decade: in 1900 there were 21 creameries and one cheese factory, against five creameries in 1890; the capital had increased from \$19,085 to \$88,155, and the value of products from \$124,780 to \$252,890.

Outside of its one great manufacturing city, the agricultural interest is supreme; no other State compares with it in the proportion of land under cultivation. Of the total land surface of 1,254,000 acres, 1,066,228 was in farms in 1900, and 754,010 were improved, or 60 per cent of the whole soil. Less than half the farmers own their own farms, and nearly the same number work on shares. The thin soil of the south—which reduces the average value of farms from \$45 in the north to \$12—has also made heavy use of fertilizers necessary. Stock farming is not much practised, save milch cows.

*Manufactures.*—While Delaware as a State is predominantly agricultural, the enormous relative magnitude of its one great city, Wilming-











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tion (containing two fifths of its entire population), and the industries concentrated around it, makes the northern end a very important manufacturing section. The great natural advantages of the spot were early utilized; the deep harbor for building the largest ships, the 100-foot falls of the Brandywine four miles from its mouth, and the proximity to the great coal and iron fields of Pennsylvania, Maryland, and Virginia. All branches of iron and steel manufacturing are carried on to an immense extent. The first iron sailing vessel in the country was built in 1854 in Wilmington, which had previously been noted for building wooden ships; and up to 1900 that city had built over 400 iron and steel steamers, more and of greater aggregate tonnage than any other single port in the United States. The two companies there built 13 such vessels in 1900. Pumping and mining apparatus and paper-making machinery are famous specialties; in 1817 the first endless-sheet paper machine was set up in Wilmington, revolutionizing the business. Its manufactories of steam and street cars, machine tools, engines, boilers, etc., are known all over the globe. Next to iron and steel comes the dressing and manufacture of leather, in which Delaware stood sixth of the United States in 1900, against ninth in 1890. Wilmington has one of the largest morocco plants in the world. The flouring-mill industry comes next, but is slightly falling off, as this business tends to go West; then the manufacture of fertilizers; and next the canning business; both of which are increasing immensely, and more than doubled in the decade. There is a considerable textile manufacture, but not as much as formerly. The most interesting concern is the great powder works of the Du Ponts on the Brandywine, a few miles from Wilmington, the oldest and largest of the kind in the country. The company was founded by the French exile, Du Pont de Nemours, in 1802, and till 1902 remained a family preserve; in that year it was turned into the E. J. Du Pont de Nemours Company, with a capital of \$20,000,000. There is a petroleum refinery at Marcus Hook.

**Fisheries.**—The oyster, shad, and sturgeon fisheries of the State are of considerable magnitude, the whole fish catch being worth some \$250,000 a year and employing about 2,500 men.

**Commerce and Transportation.**—The Delaware district reports over \$750,000 a year of exports and imports, and clears about 250 vessels. Wilmington, Lewes, and New Castle are ports of entry, and the former is a customs district. It has some direct foreign commerce, a steamer line to New York, and coasting lines to Philadelphia and down the bay; besides communication with Baltimore by the Delaware & Chesapeake Canal (see CANALS), 13½ miles long, 66 feet wide, and 10 feet deep, completed in 1829. The great Delaware Breakwater opposite Lewes was begun the year before, and completed 1869; it cost over \$2,000,000, and forms an artificial harbor some 300 acres in extent, with 24 feet of water. (See DELAWARE BREAKWATER.) Railroad facilities are excellent; there are about 360 miles of main track in the State. The one great line, which serves nearly all the State, is the Philadelphia, Baltimore & Washington, whose main line runs through it lengthwise from Wilmington to Delmar at the southern boundary, where it connects with another to Cape Charles and Norfolk; its Delaware, Maryland & Virginia

branch in the southeast serves that portion. Other branches run from it. In the north, the Baltimore & Ohio, and the Philadelphia, Wilmington & Baltimore division of the Pennsylvania system, parallel each other through Wilmington and the line to Philadelphia and Baltimore. Queen Anne's Railroad runs across the centre to Chesapeake Bay.

**Banks, etc.**—There are 20 national banks in Delaware, with a capital of some \$2,250,000, and deposits of about \$7,000,000; reserve, about \$2,500,000. There are also two State banks, with \$600,000 capital, deposits of \$1,750,000, and resources of \$3,000,000; and two mutual savings banks, with deposits of over \$5,000,000. In these regions, however, the building and loan association takes largely the place of the northern savings bank. There are several local fire and mutual life-insurance societies.

**Churches.**—The strongest religious denomination is the Methodist Episcopal; next in order of size are the Presbyterian, Protestant Episcopal, Baptist, Roman Catholic, Quakers, and Lutherans; and there are several smaller ones. There are about 1,200 church organizations, and an enrolment of toward 50,000 members. Wilmington is the seat of the Roman Catholic diocese of that name, embracing Delaware and part of the southern peninsula, and of the Protestant Episcopal diocese of Delaware.

**Charities and Penal Institutions.**—There is a State Insane Hospital, with about 350 inmates. There being no State institutions for the feeble-minded, deaf-mutes, or the blind, the statutes permit five of the last two classes from each county, and 14 imbecile children from the State, to be maintained at institutions of other States; and they are so kept at Philadelphia and Washington. The Ferris Industrial School for Boys at Wilmington has about 75 inmates. There is a public workhouse in Newcastle County, with indeterminate sentence. The whipping-post is a punishment for minor offenses.

**Education.**—The public schools are supported by local taxes; by a State distribution of the income of a fund now some \$580,000, and of the proceeds of certain taxes, both yielding about \$140,000 a year, devoted entirely to paying teachers' salaries and furnishing free text-books; and by an annual appropriation beyond this, fixed by the constitution at a minimum of \$100,000. The teachers number about 640 females and 210 males; the salaries of the former averaging about \$34 a month and of the latter \$36.60. The school year is longer and schools much more developed in the Wilmington district than elsewhere; and this manufacturing section has been prevented from greatly improving the system by its under-representation in the State government, due to an unfair apportionment. Of about 50,000 children in the State, between 5 and 18, something over half attend school for six months and more, and about 4,000 others for shorter periods; it is notable that the attendance of foreign-born children, and native-born of foreign parents, is much higher than that of the pure natives, owing to the former being concentrated in Wilmington, where the schools are best. There are separate schools for the colored population, and a State agricultural college for them at Dover, which graduates three or four annually. There are 14 academies, seminaries, and high schools; and one college, Delaware College at Newark (coeducational), with scientific

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and normal departments. It had 114 students in 1902. Otherwise there is no normal school; but there are teachers' institutes in each county. There is a State Board of Education, and in each county a school commission and a superintendent of public instruction.

*Government.*—The present constitution is of 1897; following the now usual Southern practice, it was not submitted to the people. The registration and educational provisions for the franchise enable the exclusion of all whom the governing classes think unfit. The legislature has a senate elected for four years and a house for two. The senate has seven members from Newcastle County (Wilmington, etc.), and five from each of the other two; the house has 15 members from Newcastle and 10 from each of the others. Sessions are biennial. Provisions for revenue and impeachment are the same as in the national Constitution. The members are paid \$6 a day up to 60 days, after which they sit at their own expense; special sessions are thus limited to 30 days. The State officers are chosen for four years. The governor has a veto by items; his pardoning power is on recommendation of a board of pardons. The judiciary is composed of a supreme and superior court, a court of chancery, orphans' court, court of oyer and terminer, and registers' court; there are six judges,—a chancellor and five "law judges," of whom one is chief justice. They are appointed by the governor for 12 years, with the concurrence of the Senate.

The State has one representative in Congress, and therefore three members of the Electoral College, chosen by popular election.

There is a National Guard of 321 privates and 51 officers.

*Finances.*—Delaware's bonded debt in 1902 was \$769,750, mostly incurred in 1887 and 1897. The assets were \$1,118,509.16, over \$1,000,000 invested. The State expenditures were \$341,000. There are no State taxes on individuals; the receipts are from fees and licenses, inheritance tax, special tax on banks and railroads, etc. The assessed valuation of the State is about \$76,000,000.

*Divisions and Population.*—The State has three counties: Newcastle, Kent, and Sussex. The former, containing Wilmington, has three fifths the entire population of the State. The counties are divided into "hundreds" instead of townships, the towns being included in the hundreds. There are 35 incorporated cities and towns, of which Wilmington is the only large one; it had 76,508 in 1900, and has about 80,000 now. Of the others, the chief are New Castle, 3,380, a decrease from 4,010 in 1890; Dover, the capital, 3,329, slightly growing; Milford, 2,500; Lewes, 2,259; Smyrna, 2,168.

The population from the first census to the last is as follows: 1790, 59,094; 1800, 64,273; 1810, 72,674; 1820, 72,749; 1830, 76,748; 1840, 78,085; 1850, 91,532; 1860, 112,216; 1870, 125,015; 1880, 146,608; 1890, 168,493; 1900, 184,735. Of these, the males were 3,581 in excess. The colored were 30,758, or almost one sixth. The foreign-born numbered 13,810; the native-born of foreign parentage, 22,219. In Indian River hundred, Sussex County, there is a considerable body of "white Indians" or "Moors," traditionally descended from a band of shipwrecked Moorish sailors. They do not associate with

the colored race, and maintain separate schools and churches with the help of the State.

*History.*—Delaware represents the sole attempt of Sweden to seize its share of America. It does not take its name from the Indians who inhabited it, but from the river and bay, named by the English after Lord de la Warr, who explored it in 1610; the Dutch called the river "South River," as distinguished from the "North River," the Hudson. The first settlement actually made in Delaware was by the Dutch trader, De Vries, in 1631, at Paradise Point, the present Lewes; he called it Hoornkill, from his Dutch home, but the English corrupted it to Whorekill, and invented a story to account for the name—as usual. The agent he left there fell out with the Indians, who slaughtered the whole settlement and burnt the manor house. In 1637 Axel Oxenstiern, the great Swedish minister of Gustavus Adolphus, revived his dead master's plan of founding a Swedish West India Company, and sent Peter Minuit, the ex-director-general of New Netherlands, with a mixed Swedish and Dutch expedition to seize and settle a point on the coast. Minuit landed April 1638, and fixed on the peninsula, where Wilmington now stands, about two miles back from the Delaware; he called the creek "the Elbe," and built a fort which he called Christina, after the girl-queen of Sweden, Gustavus' daughter. The creek later was given that name, now corrupted to Christiana, locally and more correctly Christeen. The entire domain he called New Sweden. The Dutch protested, but as their company had to pay its own war bills, they did no more; and in 1640 the Swedish government sent another body of colonists. More Dutch came also and settled some miles below; the stockholders of the enterprise were part in Holland and part in Sweden, and each party sent its own countrymen. The Swedish settlements were vigorous and spread rapidly, colonizing New Gottenburg at Tinicum Island and Upland near by, driving a New Haven English colony off Salem Creek in New Jersey and keeping the place themselves, with a fort called Elsenburg. In 1646 the Dutch built a block-house on the site of Philadelphia, opposite Fort Nassau built by them in 1623; the Swedish governor, Printz, marched there and pulled it down. But when Stuyvesant came to New Netherlands in 1647, he was under orders to fight; and in 1651 he built Fort Casimir on the site of New Castle, blocking the Delaware to the Swedes. Rising, Printz's successor, attacked and captured it in 1654, and changed its name to Trinity. Stuyvesant came down in 1655 with a large force, captured not only Trinity, but Christina, deported the officers to New Amsterdam, and forced the rest to swear allegiance to the Netherlands or leave the country. Trinity was renamed New Amstel. The Swedish dominion was ended; but its blood remained, and the tradition of alien independence in the mixed colonial strain made it utterly unassimilable, and has created the present State. The Dutch divided it into the historic three counties.

When the Duke of York took New Amsterdam from the Dutch in 1664, the Delaware settlements went with it, and New Amstel was renamed New Castle. When the Dutch retook New York in 1673, there was a renewed Dutch rule on the Delaware. In 1682 (24 August), William Penn, to give his new colony control of

## DELAWARE — DELAWARE INDIANS

the mouth of the Delaware, bought the lower settlements; it then contained about 6,000 Swedes, English, Dutch, and mixed breeds, who had always been governed by themselves or by a deputy from New York. He also bought a lingering boundary dispute with the Baltimores, not settled till 1768. The lower river settlements were at first governed as part of Pennsylvania, being called the "Three Lower Counties on the Delaware," and sending six representatives apiece to its legislature; but there was no community of interest and a violent discontinuity of feeling, and the lower counties insisted on a separate legislature. They obtained it in 1703, with a separate council in 1710, and kept it till the Revolution, the sessions being held at New Castle. The same governor was appointed for both, however. In the Continental Congresses the colony was separately represented, as "The Counties of New Castle, Kent, and Sussex, upon Delaware"; and on 21 Sept. 1776 it proclaimed a State constitution as "The Delaware State." For some years, however, it chose the same governor as Pennsylvania. It was the first (7 Dec. 1787) to ratify the national Constitution. In 1792 it adopted a new constitution and the name of "The State of Delaware"; in 1831 a third, and in 1897 the present one.

Delaware's naturally divided position as a slave-holding border State has been sharply accentuated by the natural antagonism between its agricultural and manufacturing sections. The northern part, an outcrop of the Pennsylvania manufacturing interests, has shared the Northern sympathies; the southern has always been Southern in feeling, and sent numbers of soldiers to the Confederate side in the Civil War. But the large preponderance of population in the north, though hampered by an unjust system of representation, made itself vigorously felt in the War; the legislature promptly voted "unqualified disapproval" of the proposal to secede; it answered the calls for Union troops so quickly and fully that Lincoln said in his message of 3 Dec. 1861, "Noble little Delaware led off right from the first"; and out of its 40,000 males from 14 to 60, it sent nearly 14,000 men to the Union armies, or over one third. When Reconstruction began, however, the legislative majority sympathized with their class, and denounced the Fourteenth Amendment, which the new constitution virtually abrogates. The leading element in the State politics since 1850 has been the "peace Democrats," devoted to the Union, but opposed to coercion of the States; as exemplified in the Bayard family (see BAYARD, JAMES A., 2D, and THOMAS F.). The Democratic majority, however, has been always small, except in 1878, when the Republican party was temporarily ruined by joining the Greenback-Labor movement. This balance has formed the basis of the effort for some years to win over Democrats enough to send John E. Addicks to the Senate (see ADDICKS, JOHN E., for a full description of the details), which has resulted in depriving Delaware of one senator for some years and of both latterly.

The people of Delaware are familiarly termed "The Blue Hen's Chickens," from their Revolutionary flag. As such, they were among the finest regulars in the Continental army.

**Delaware**, Ohio, city, county-seat of Delaware County; on the Whetstone (Olentangy) River, and on branches of the Cleveland, C.

C. & St. L., the Columbus, S. & H., and several other railroads; 24 miles north of Columbus. It is the trade centre of Delaware and surrounding counties, and has manufactures of iron, flour, woolen, lumber, furniture, agricultural implements, etc. It is the seat of Ohio Wesleyan University, and the Ohio Wesleyan Female College. There are sulphur, magnesia, and other mineral springs nearby, and the city has large railroad repair shops, hotels, daily and weekly newspapers, and two national banks. Pop. (1900) 7,940.

**Delaware Bay**, a large bay or arm of the sea, between the States of Delaware and New Jersey. The Delaware River and several small streams flow into this bay. It is 65 miles long, and in the centre about 30 miles across, and about 15 at its mouth, from Cape Henlopen to Cape May. At the entrance to this bay, near Cape Henlopen, is situated the Delaware Breakwater, the object of which is to afford vessels a shelter within the cape. The breakwater proper is 1,200 yards in length, and runs in a straight line from east-southeast to west-northwest, leaving an entrance 650 yards wide between its east end and the north point of the cape. It serves also as an ice-break against the floating ice which sometimes comes down the bay. At the distance of 350 yards from the upper or western end of the breakwater a similar dike, of 500 yards in length, is projected so as to form an angle of 146° 15' with the breakwater. Government lighthouses are stationed at the entrance, to indicate shoal places in the channel and breakers along the shore.

**Delaware College**, an institution founded at Newark, Del., 1833, closed in 1859. In 1870 it was reopened as a "Land Grant College"; the State of Delaware appropriating funds received under the Land Grant Act of 1862. Further aid received from the State funds obtained under the congressional act called the "Hatch Bill," enabled the college to open an experiment station in 1887. A still further grant was received under the act of 1890. The library contains (1903) about 14,000 volumes; the number of students enrolled in 1902, 75.

**Delaware Indians** (their own name Renno Renappi, or Lenno Lenape, "men": cf. Illinois, Innuít, Lokono, Muysca, Alemanni, etc.), an important Algonquin tribe which lay in the path of white settlement on both sides of the Delaware River, and therefore fills a large place in colonial history. Previously they had been subjugated by the Iroquois, who, instead of exterminating or absorbing them, exacted tribute, called them "women," and dictated their action. The early Dutch settlers were massacred as usual; but the Swedes on the Delaware upheld Indian titles to land to secure their own possession against the Dutch, compelling the latter in turn to buy instead of seizing, so there was peace with the Delawares in this period. The Swedes tried to Christianize them with Luther's catechism, without much success. In October 1682 Penn made his famous treaty with them, as well and as ill kept by his successors as others of the kind; that the Delawares did not revenge the white encroachments by massacre was due to Penn's sagacity in buying up their overlords, the Iroquois, who threatened to destroy them if they molested "Onas'" people. The infamous trick

## DELAWARE RIVER—DELEB PALM

of the "Walking Purchase" (q.v.) in 1737 (denounced by the Quakers) ousted them from half a million acres in the forks of the Delaware above Easton, and the Iroquois with furious menaces compelled them to retire to the Susquehanna. Here settlement pursued them, and not daring to resent it, a large part of them by 1750 had removed to the Allegheny and Muskingum, where they recovered Indian courage and ferocity. The Moravian missionaries converted part of the remainder, and these always remained peaceful. The others, maddened by aggression, joined the French and Iroquois in the French and Indian war, and helped in Braddock's defeat; sullenly yielding in 1758, after the Senecas had turned against them, they broke out again in Pontiac's Conspiracy (q.v.) of 1762, and were among the besiegers of Detroit, Fort Pitt, Duquesne, etc. Defeated by Bouquet at Bushy Run, 1763, they made peace in 1764-5. In 1768 all the remnants east of the Alleghenies migrated west; and the Christian Delawares founded the village of Gnadenhütten on the Muskingum. Roving bands of the others kept the field till the crushing defeat of Point Pleasant (q.v.), 1774. In the Revolution they were divided; part went with the English, part made a treaty with Congress in 1778. The Christians remained quietly at Gnadenhütten, till in 1781 the English broke it up and removed them to Sandusky. Part of them returned thither to save their crops, and were attacked by the Americans and 90 of them murdered; the rest fled mostly to Canada. Land was given them on the Thames, and they founded Fairfield, with others who came in 1787 from the Muskingum, where Congress had settled them. The wild tribesmen remained hostile, and contributed to St. Clair's defeat in 1791; but Wayne's victory forced them to make peace in 1795. Successive treaties removed them from Ohio, and by 1800 the main body were on White River, Indiana. They did not join Tecumseh in the War of 1812, and in 1818 they ceded all their lands east of the Mississippi and moved to White River, Missouri. There were then 1,800 in all, a few remaining in Ohio. Later, some went south to Red River, on the Texan border, by Spanish permission. By treaty of 24 Oct. 1829 the main body, about 1,000, settled on the Kansas and Missouri. They had schools and missions. In 1853 they sold all but a reservation in Kansas, invested the money sagaciously, and built fair houses, improved their farms, etc. During the Civil War, out of 201 warriors they sent 170 to the Union side, who proved good soldiers and guides. In 1866 their land was cut up by the Union Pacific Railroad, and they sold the whole in 1867-8, and took up lands on the Verdigris and Cane, bought from the Cherokees. A special treaty of 1866 permitted them to take lands in severalty and become citizens, they did so, and are not a "tribe" any longer, though they form a part of the "Cherokee Nation" in Indian Territory, numbering now 780. There are other bands, which in all make more than 780. They had three clans, the Turtle, Turkey, and Wolf or Munsee (q.v.); the latter, differing strongly from the rest, is in three divisions,—120 on the Thames in Canada, about 200 at Green Bay, Wis., with the Stockbridges, and some 50 with the Chippewa in Kansas. There are also 95 on the late Wichita reserve in Oklahoma, 135 on Grand River reserve in Ontario, and 350 Moravians on the Thames.

**Delaware River**, in the eastern part of the United States, has its rise in the Catskill Mountains in New York. It forms the boundary line for a short distance between New York and Pennsylvania, is on the whole length of the boundary line between Pennsylvania and New Jersey, and flows into Delaware Bay about five miles below Newcastle. It is navigable for vessels of the largest size to Philadelphia, 55 miles above the head of the bay, and about 120 from the ocean; for sloops to the head of the tide, at Trenton, 35 miles above Philadelphia; and for boats about 100 miles farther, though the boat navigation above Easton is very difficult. Its most important tributaries are the Schuylkill and the Lehigh. The whole length from its source to the bay is about 300 miles. The principal towns on the Delaware, besides Philadelphia, are Burlington, Trenton, and Easton.

**Delaware Water Gap**, Pa., village in Monroe County, on the Delaware River and the Delaware, Lackawanna & Western, the New York, Susquehanna & Western railroads; near Stroudsburg, Pa., 65 miles northwest of New York. The railroad station is called Water Gap. The place is visited annually by a number of tourists because of the remarkable channel made here by the Delaware River, where it passes through the Kittatinny Range of the Appalachian Mountains. The gorge is about three miles in length, and above the water the sides rise to the height of 1,400 feet.

**Delawarr**, or **Delaware**, **Thomas West**. See WEST, THOMAS, LORD DELAWARR, or DELAWARE.

**Del'brück**, **Martin Friedrich Rudolf von**, German statesman: b. Berlin 16 April 1817; d. there 1903. Entering public life in 1849 he was made director of the division of commerce and industry, and his part in detaching Prussia from the Austrian commercial policy was considerable. After 1862 Bismarck, then president of the cabinet, supported von Delbrück's commercial ideas, and upon the same principles he negotiated treaties with foreign powers. In 1867 Delbrück was made president of the imperial chancellery. Later he negotiated the treaties which made Germany a unit. For five years after the founding of the empire Delbrück retained his office as president of the general chancellery, now become the imperial chancellery. In 1876 he was dismissed in spite of his reputation and service. Later, as a member of the Reichstag, he dared oppose Bismarck. He retired from the Reichstag in 1881. He published 'Der Zollverein und das Tabaksmonopol' (1857); 'Der Artikel 46 der Reichsverfassung.'

**Delcassé**, **Théophile**, tā-ō-fēl dēl-kā-sā, French editor and statesman: b. Pamiers, France, 1 March 1852. For some time on the staff of 'La République Française' and was elected deputy from Foix 1889 and re-elected 1893 and 1898. He was under-secretary of state for the colonies and became minister for the colonies in 1894. He was minister of foreign affairs in Brisson's cabinet, holding the same office under Dupuy and Waldeck-Rousseau. He settled the "Fashoda Affair" with England and gave an eastern frontier to the possessions of France in Africa. He also concluded a commercial convention with the United States.

**Deleb' Palm**, the *Borassus Ethiopum*, a native of the interior and west of Africa, allied

to and somewhat resembling the Palmyra palm (q.v.). Its leaves and fruits are used by the Africans for the same purposes as those of the Palmyra by the Asiatics, and the tender roots produced by the young plant are extensively used as an article of food. The trunk is swollen about halfway up.

**Delécluze, Etienne Jean**, ā-tē-ñ zhōñ dē-lā-klüz, French painter and critic: b. Paris 20 Feb. 1781; d. Versailles 12 July 1863. He was a pupil of David, and although achieving a fair success in painting he abandoned it for criticism 1816. He was connected with several reviews and papers, including the *Moniteur* and the *Journal des Débats*, and the *Revue des Deux Mondes*, being allied with the young literary circle of the Restoration. He also wrote several novels. Among his many works are: 'History of Painting' (1828); 'Mademoiselle Justine de Liron' (1832); 'Life and Works of Leopold Robert' (1838); 'Dona Olympia, the Sister-in-law of Pope Innocent X.' (1842); 'Gregory VII., St. Francis d'Assisi and St. Thomas Aquinas' (1844); 'Louis David, His School and His Times' (1855); and 'Souvenirs of Sixty Years' (1862). In the museum at Versailles there are some curious pen and ink sketches by him of scenes of the invasion of Paris in 1814. Among his paintings are: 'Death of Astyanax'; 'Carrying off Europa'; 'Paris Carrying off Helen'; 'Sacrifice to Ceres', and 'Augustus and Cinna.'

**Delegate**, a person appointed and sent by another or by others, with powers to transact business as his or their representative. The title was given to members of the first Continental Congress in America 1774. Representatives to Congress from the United States Territories are still designated by this term. They have the right of discussion, but have no vote. A delegate in old English law was one of a body of commissioners, so called because delegated or appointed by the king's commissioners under the great seal, to sit upon an appeal to the king in the court of chancery.

**Delegates, Court of**, the old English court of appeal, and was so called because the judges thereof were delegated, by the king's commission under the great seal, to hear and determine appeals in the three following cases: (1) Where a sentence was given in any ecclesiastical cause, by the archbishop or his official; (2) when any sentence was given in any ecclesiastical cause in the places exempt; (3) when a sentence was given in the admirals' court, in suits civil and marine, by order of the civil law. This court has been abolished, and the privy council is now the great court of appeal in all ecclesiastical causes.

**Delegation**, the investing with authority to act for another. Hence the name has been given to a body of persons thus deputed. Before the present Constitution of the United States of America was adopted, the persons constituting the Congress at Philadelphia were called delegates, and the body of representatives of a State in Congress are still called the delegation of a State. In Maryland and Virginia the branch of the State legislatures which, in most of the other States, is called house of representatives, has the name of house of delegates. The name of delegate is also given to the representatives sent to the Congress of the United States from

Territories not yet formed into States. In Italy branches of government are often called *delegazione*, and their members *delegati*. Formerly in Lombardy, Venice and the states of the Church the term *delegazione* was applied both to the governor and governing court of a province and to the province itself. The delegate was always a prelate, and directly appointed by the Pope.

In the civil law delegation is that act by which a debtor transfers to another person the duty to pay, or a creditor transfers to another person the right to receive payment.

**Delenda**, dē-lēn'da, things to be erased or expunged. *Delenda est Carthago* is the celebrated sentence with which Cato the elder was accustomed to conclude all his speeches in the Roman senate. His hatred of Carthage arose from a jealousy of its flourishing state, and the consequent danger to Rome.

**De Leon, Edwin**, American prose writer: b. Columbia, S. C., 1828; d. New York 1 Dec. 1891. From 1854 to 1862 he was engaged in editorial work; from 1862 to 1870 held the office of United States consul-general and diplomatic agent at Cairo, Egypt. His published works include: 'Thirty Years of My Life on Three Continents'; 'The Khedive's Egypt,' a novel; 'Askaros Kassis, the Capt'; and 'Under the Star and Under the Crescent.'

**De Leon, Thomas Cooper**, American author and playwright: b. Columbia, S. C., 21 May 1839. He was auditor Topographical Engineering Bureau, Washington, 1858-61, served in Confederate army 1861-5, and at the close of the war was connected with magazine and newspaper work in Baltimore, New York and Mobile. He organized the Mobile Mardi Gras Carnival and was its manager for 25 years, and has designed carnivals for many other cities for their various celebrations. Among his works are: 'The Rock or the Rye'; 'Creole and Puritan'; 'A Fair Blockade Breaker'; 'The Puritan's Daughter'; 'Four Years in Rebel Capitals'; 'Out of the Sulphur'; 'A Bachelor's Box'; 'An Innocent Cheat'; 'Crag Nest'; 'Life of Joseph Wheeler'; and 'Confederate Memories.'

**Delescluze, Louis Charles**, loo-ē shārl dē-lā-klüz, French communist: b. Dreux 20 Oct. 1809; d. Paris 28 May 1871. The February revolution opened to him a career in Paris, where his clever and facile pen quickly made him popular with the rabble, but earned him from the authorities imprisonment and a fine of 10,000 francs. Again at Paris in 1853, he was sentenced to two years' imprisonment, and was next transported to Cayenne, where he remained till 1859. His experiences of his sufferings he gave in 'De Paris à Cayenne: Journal d'un Transporté' (1867). After his return he was quiet for some years, until his journal, 'Réveil,' started in 1868 to advocate the doctrines of the International, brought him anew into trouble. In the history of the Paris Commune he played a prominent part, and upon his head rests in great part the guilt of the murder of the hostages, and the burning of the public buildings of the city. He died on the last barricade.

**Delessert, Benjamin**, bōñ-zhā-mǎñ dē-lēs-sār, French naturalist and philanthropist: b. Lyons 14 Feb. 1773; d. Paris 1 March 1847. In 1803 he started cotton-spinning in France, but is particularly distinguished by his efforts to pro-



## DELFT—DELHI

duce beet-root sugar. As early as 1801 he was engaged in refining, but in 1806 he began the experiments which were successfully terminated and announced to Chaptal on 2 Jan. 1812. When he heard of it Napoleon was in ecstasies: "We must see it: let us go," he said. "Delessert," says Flourens, who narrates this incident, "had just time to go to Passy, where his work was. On his arrival he found the gates surrounded by the imperial chasseurs, who refused him admittance. He told them who he was and entered. The emperor had seen and admired everything; excitement was at its height. Approaching Delessert, the emperor took the cross of the Legion of Honor from his own breast and gave it to him. It was announced next day in the *Moniteur* 'that a revolution in French commerce had been accomplished.'" Delessert lived through the collapse which the manufacture suffered after Napoleon's fall, and long enough to see it revive and become of the greatest importance.

**Delft**, or **Delf**, Holland, town in the province South Holland, eight miles northwest of Rotterdam. It stands on a dead flat, and is intersected in all directions by canals, which are crossed by 69 bridges, mostly of stone. These canals make the great market-place with its public buildings an island, approached by nine bridges. The counterscarps of the old ramparts are now planted with trees, and form public walks. The town-hall (*Stadhuis*), in the market-place, is a large, solid-looking building, with a heavy square tower rising from its roof. The Prinsen-hof, once the occasional residence of William I. of Orange, and the scene of his assassination, is now a military barracks. The old Reformed church contains the monuments of Admirals Tromp and Hein, the famous naturalist Leeuwenhoek, and other worthies. The magnificent mausoleum of William, and the burial-place of the Orange family, are in the new church (1412-76); and from its huge square tower the town and neighborhood are from time to time regaled with the richest music from a chime of three octaves; the new church contains also the tomb of Hugo Grotius. Delft has long been the seat of an arsenal, and was formerly the centre of the manufacture of the kind of pottery called delftware or delf. The chief manufactures now carried on comprise firearms, carpets, leather, soap, oil, and gin. In 1654 the powder magazine of the arsenal exploded accidentally, when not a single house entirely escaped, and many persons were killed or maimed. Pop. 32,021.

**Delftshaven**, *dëlfts-hä'vën*, or **Delfshaven**, formerly a small independent town in Holland, but included in Rotterdam (q.v.) since 1886. The place is noted as having been the point of embarkation of the Pilgrim Fathers when, in 1620, they sailed for America.

**Delftware**, or **Delf-ware**, a kind of pottery originally manufactured at Delft, in Holland, in the 14th century. It was among the best of its day, many examples being considered equal to the Italian in quality, but somewhat inferior in its ornamentation. It is covered with an enamel or white glazing which gives it the appearance of porcelain. The glaze of the delftware is made as follows: Kelp and Woolwich sand are calcined together, to form a vitreous mass called frit. Lead and tin are calcined to form a gray,

powdery oxide. The frit is powdered and mixed with the oxide, zaffre being added to confer blue color, arsenic for dead-white. This is fused, making an opaque enamel; ground and mixed to the consistency of cream. Delftware is made of a calcareous clay of varying color, strained, and evaporated to a plastic consistency; it is then tempered, and stored in cellars to ripen. Prolonged storage increases its tenacity and plasticity. It is then kneaded without sand; formed on the wheel, dried, and partially burned, reaching the biscuit condition. The bibulous ware is then glazed, dried, packed in saggars, which are piled in the kiln and baked.

**Del'hi**, India, city in the Punjab, capital of a division of the same name, and anciently of the Patan and Mogul empires; about 700 miles northeast of Bombay, and about 790 miles northwest of Calcutta. It was at one time the largest city in Hindustan, covering a space of 20 square miles, and having a population of 2,000,000. It is now reduced to a circumference of seven miles. A vast tract covered with ruins marks the extent of the ancient metropolis of the Mogul empire. The present city, built on two rocky eminences, is surrounded by walls of red sandstone 30 feet high, and from three to five feet thick, with a moat 20 feet broad. There are seven colossal arched gates, defended by round bulwarks, and all built of freestone. The streets of the old part of the city are narrow, but in the modern portion they are broad. The houses here are of sandstone and brick, and are of two and three stories in height. The palace or residence of the Great Mogul, built by Shah Jehan, commenced in 1631, and finished in 10 years, is by far the most interesting building in Delhi, and the most magnificent structure of the kind in India. The Great Mosque, a magnificent structure in the Byzantine-Arabic style, is considered by the Mohammedans the wonder of the world. It is built of white marble and red sandstone, inlaid like mosaic, in lines and arabesques; at the two extreme corners rise minarets 150 feet high, and between them two lofty domes. This imposing edifice was built by the Emperor Shah Jehan, in the 17th century, and took several thousand men for six successive years (1631 to 1637) to complete it. There are no fewer than 40 other mosques in different parts of the city, many of them having lofty minarets and gilded domes. The fine structure which stands near the Ajmeer gate was formerly the Delhi College. The famous observatory of Jye Singh, rajah of Jyepoor, at the southwest extremity of the city, has been much dilapidated, and its astronomical instruments nearly all destroyed or carried off. A monument was erected in 1888 by the government to Willoughby, one of the heroes of the siege in 1857. The principal manufactures of the town are cotton cloths, indigo, finely embroidered shawls and jewelry, for which, as well as for delicately carved ivory, Delhi is somewhat noted. The chief imports are by the northern caravans, which bring from Cashmere and Cabul shawls, fruit, and horses. Precious stones of good quality are to be had at Delhi, particularly the large red and black carnelians. The agricultural products of the district consist chiefly of wheat, rice, millet, and indigo. The trade of the neighborhood is centred in Delhi, and the Rajputana State Railroad traverses the district.



## DELHI — DELIRIUM

Delhi, or as anciently called, Indraprastha, is one of the oldest cities of India. The modern name Dilli or Delhi is first met with in the 1st century B.C. It has been taken frequently by hostile powers. In the beginning of the 19th century the prosperity of the city and country around was threatened with destruction, and the Mogul emperor and royal family were reduced to poverty and distress, by the Mahrattas, who took possession of his capital, of his gardens and houses, and used his name to oppress and impoverish the people by fraud and extortion. From this miserable state of desolation and ruin the city was rescued by the British in 1803, when it was entered and taken possession of by Lord Lake. On the breaking out of the Indian mutiny in May 1857, Delhi became the centre of the operations of the rebels, who flocked to it from all quarters. The nominal representative of the Great Mogul, who held the sovereignty of the place under British protection, joined cause with the rebels; and in addition to assuming the character of an independent potentate, gave his sanction to the massacres and atrocities perpetrated on the European residents. By the middle of June a British army assembled in front of the city, and a siege commenced, which, from the smallness of the besieging force, was necessarily slow and protracted. It was brought to a successful termination on 20 September, when Delhi was entered by the British troops, and the nominal sovereignty heretofore possessed by the king was declared ended; and he himself, after being tried for the murders committed under his authority, was found guilty, and sentenced as a convict to perpetual banishment. A large part of the place was reduced to ruins in the mutiny and siege, but it has since recovered much of its former appearance, and has also been much improved in its sanitary condition. Pop. 208,385.

**Delhi**, N. Y., village and county-seat of Delaware County; on the Delaware River, and a branch of the New York, Ontario & Western Railroad, about 55 miles east of Binghamton. It is in one of the best dairying regions in the country, and the trade is largely in butter, cheese, eggs, and agricultural products. Pop. 2,100.

**Delibes**, Clément Philibert Léon, klā-môn fē-lē-bār lā-ôn dē-lēb, French composer: b. St. Germain du Val 21 Feb. 1836; d. 18 Jan. 1891. He entered the Paris Conservatoire in 1848, and in 1855 produced an operetta, 'Two Bags of Charcoal.' At the Grand Opera, where he became second director in 1865, his music for the ballet 'The Fountain' (1866), met with great success, and his ballet-music for 'Coppélia' (1870), his finest work, secured his position as a composer. He wrote music for a third ballet and for three comic operas, one of which, 'The King Said So' (1873), became very popular. In 1880 he was appointed professor in the Conservatoire.

**Delilah**, dē-lī'lā, the Philistine mistress of Samson. She persuaded him to reveal to her the secret of his great strength, and learning that it lay in his long and thick hair, cut off his locks while he was asleep and then treacherously delivered the helpless man into the hands of his enemies.

**Delille**, Jacques, zhāk dē lēl, French didactic poet: b. Aigueperse, Auvergne, 22 June 1738;

d. Paris 1 May 1813. His translation of Virgil's 'Georgics,' published in 1770, with a 'Discours Préliminaire' and numerous annotations, established his fame and obtained him admission to the French Academy. He became professor of Latin poetry in the College of France, and of belles-lettres at the University of Paris. Though an adherent of the old system, Robespierre spared him on every occasion. At his request Delille wrote the 'Dithyrambe sur l'Immortalité de l'Âme,' to be sung on the occasion of the public acknowledgment of the Deity. His reputation mainly rests on the 'Georgics' and 'Les Jardins,' a didactic poem. Other works are 'L'Homme des Champs'; 'La Pitié'; 'Les Trois Règnes de la Nature'; 'La Conversation'; 'L'Énéide de Virgile.'

**Deliques'cence** (Lat. "to melt away"), in chemistry the property manifested by many salts, of absorbing moisture from the atmosphere until they become distinctly damp. The name is usually applied to the more pronounced cases, in which the moisture absorbed is so copious that the salt becomes visibly wet, or even dissolves entirely; salts in which the action is less pronounced being called "hygroscopic." Carbonate of potash, caustic potash, and chlorid of calcium are familiar examples of deliquescent substances.

**Delirifa'cient**, any drug that induces an irritability of the brain leading to forms of delirium. Thus alcohol for some susceptible minds invariably leads to delirium in the early stages, and also induces delirium in chronic poisoning. Belladonna is a drug that causes a certain amount of delirium, as do also cannabis indica, cocaine and its allies. Opium in small doses brings about an exhilaration and for some delirium. Mescal, a drug widely used among the Indians of South America and of the southwestern United States, also induces a form of delirium. Delirifacients are rarely used in medicine for the effect on delirium.

**Delirium** is a temporary general disturbance of consciousness, a perversion of the intellectual and perceptive faculties, characterized by a greater or less degree of mental irritation or confusion, by more or less transitory delusions and fleeting hallucinations, accompanied by disordered, senseless speech and muttering, and motor unrest. It varies in degree from the ordinary wandering or flightiness of the lower form, to the higher, excited or more violent form, closely approaching mania.

Delirium is one of those conditions or symptoms to which the word "functional" is applicable, since it is not a disease *sui generis*. The word itself is a curious derivative from "de," from, and "lira," a ridge between two furrows. The Latin word *delirare*, signifying to deviate or wander from a straight line, figuratively—to be crazy, deranged, out of one's wits, to be foolish, to rave. Hence the term "wandering" so often associated with, and used to express, the presence of delirium. This wandering need not necessarily imply that of speech alone, for a deaf-mute or an aphasiac may become as delirious as any other person. Delirium is unquestionably experienced by dumb animals.

Continuous or chronic delirium necessarily merges into insanity; though the term delirium should not be used synonymously with insanity, even admitting that the former implies, or pre-

## DELIRIUM TREMENS — DELITZSCH

supposes, an unsound mind at the time of its inception.

False beliefs, false or perverted sense perceptions, also constitute a part of the mental condition known as delirium.

Two distinct varieties of delirium are recognized (although transient forms exist), namely, the primary active or wild form, *delirium acutum*, *delirium grave*,—and the secondary or lower form. The former is not an individual affection, but a condition of varying mental disturbance which occasionally attends different states of bodily disorder such as collapse, intoxication, katatonia, etc., and often, if not altogether, dependent upon, at least associated with, demonstrable lesions of the gray matter of the brain. It is characterized by increased restlessness, in which the patient tries to escape from bed, shouts, struggles with imaginary enemies and requires physical or even mechanical restraint. This form is generally associated with alcoholics (*delirium tremens*).

The secondary or lower form is by far the most common, and less understood, the patient lying with comparative quietness but incessantly engaged in incoherent and disjointed converse with imaginary personages, or communing with his own disordered brain. It generally appears in the exanthematous diseases of children, measles, scarlet fever, etc., also in the second and third weeks of typhoid fever.

The outset of delirium may be sudden or slow. If coming slowly, the first indication of its presence may be a certain confusion and difficulty in recognizing surroundings, after awakening from sleep; the mental confusion lasting a longer period on each occasion and finally developing into a well-marked delirium. A practical point to bear in mind is that a quiet delirium may shift very suddenly into an active one.

There are innumerable causes of delirium, the more prominent ones being infectious fevers, in the young and able-bodied, diseases dependent upon some specific micro-organism, such as is seen in typhoid fever, pneumonia, scarlet fever, yellow fever, puerperal fever, pyemia, and malaria; although delirium occurs also in analogous diseases not proven directly due to any specific micro-organism, also in trauma. Surgical operations are frequently followed by delirium.

In the delirium of intoxication the causes may be divided into endogenous and exogenous, the former arising from within the body proper, such as septic intoxication, pyemic or uremic absorption, cholemia, diabetes, auto-intoxication and insolation, that is, sunstroke. The latter (exogenous) causes are alcohol, drugs, mydriatics, for example, belladonna, duboisin, atropin. Also cocaine, morphine, mineral poisons, for example, iodoform.

Delirium due to exhaustion and inanition is seen in acute anæmia, resulting from hemorrhage of any cause, or the presence in the blood of powerful hæmic poisons, for example, plasmodium of malaria. It is also due to wasting diseases and lactation.

Delirium may originate in central or peripheral lesions of the brain, for example, blood clot from accidental injury, trauma, surgical operations, meningitis or encephalitis. Delirium may also be due to, or associated with, central depression, notably that occasioned by epilepsy, hysteria major, etc.

Delirium of senility is due to inanition and pathologic changes in the cerebral vascular supply.

The delirium of disease, or acute delirium, resembles that arising during febrile diseases; it is ordinarily accompanied by rise of temperature, which pursues no definite course, and by rapid and progressive body weakness (asthenia), and the typhoid state. The treatment consists of utilizing remedial agents that rapidly produce sleep, and fighting the progressive weakness, by stimulating drugs and nutrition, quieting the motor unrest and reducing fever by hydrotherapy, etc.

Mild forms of delirium, such as occur in children suffering from measles, auto-infection from the gastro-intestinal tract, etc., require no treatment *per se*, the treatment being directed against the exciting cause. In typhoid fever and pneumonia delirium is best controlled by the ice pack or sponging with cold water and cold bath. The early inception of delirium in these fevers is a grave and dangerous symptom.

The treatment of delirium in general is first: Induce sleep, and quiet motor unrest; this is best accomplished by the reduction of fever, the exhibition of proper narcotics, thorough cleansing of the intestinal tract, and hydrotherapy. In the selection of hypnotics, the one or the group which is followed by the least depression is advisable. Hyoscamin, in sthenic cases is safe and reliable. Bromide of potash, chloral hydrate, hyoscin, morphine and opium and the various synthetic coal tar derivatives are frequently used. Second: Discover, if possible, and remove the inciting cause of delirium; to do this the pathological factor must be determined and treated accordingly.

**Delirium Tremens.** See DELIRIUM.

**De Lisle, Charles.** See LECONTE DE LISLE, C.M.R.

**Delisle, Guillaume, gē-yōm dé-lél**, French geographer: b. Paris 28 Feb. 1675; d. there 25 Jan. 1726. He was instructed by Cassini, and soon conceived the idea of reforming the whole system of geography. He published, in his 25th year, a map of the world, maps of Europe, Asia, and Africa, and a celestial and a terrestrial globe of a foot in diameter. By rejecting Ptolemy's statements of longitude, or rather by comparing them with the astronomical observations and the statements of modern travelers, he founded the modern system of geography.

**Delisle, Joseph Nicolas, zhō-zěf nīk-ō-lā**, French astronomer: b. Paris 4 April 1688; d. there 11 Sept. 1768. He was a brother of Guillaume Delisle (q.v.). Among his works are: 'Mémoires pour servir à l'histoire et au progrès de l'astronomie' (1738); 'Mémoire sur les nouvelles découvertes au nord de la Mer du Sud' (1752).

**Delitzsch, Franz**, German Hebraist and theologian: b. Leipzig 23 Feb. 1813; d. there 4 March 1890. He was educated in the university of his native city, became professor of theology at Rostock in 1846, at Erlangen in 1850, and in 1867 at Leipsic. His earlier works dealt with post-biblical Jewish literature, and he afterward wrote commentaries on various books of the Old Testament. He was also the author of numerous theological and devotional works, among which were 'Biblico-prophetic Theology' (1845); 'The House of God' (1848); 'Biblical

Psychology' (1855); 'Jesus and Hillel' (1867); 'Christian Apologetics' (1869). He was chiefly eminent as a commentator on the Old Testament, and his honesty as a theologian was shown in the concessions he was willing to make (in the last edition of his commentaries on Genesis and Isaiah, 1887) to the latest critical views of the Pentateuch.

**Delitzsch, Friedrich**, frēd'rīh dā'tīch, German Assyriologist: b. Erlangen, Bavaria, 5 Sept. 1850. He is a son of Franz Delitzsch (q.v.). He has published among other works: 'Assyrian Studies' (1874); 'Where is Paradise?' (1881); 'Prolegomena of a New Hebrew and Aramaic Vocabulary to the Old Testament' (1886); 'Assyrian Vocabulary' (1887 onward); 'Assyrian Grammar' (1889); 'Assyrisches Handwörterbuch' (1894-6); 'Das Babylonische Welterschöpfungsepos' (1896); and a translation of George Smith's 'Chaldean Account of Genesis.' In 1877 he became extraordinary professor in Leipsic, ordinary professor at Breslau in 1893, and in 1899 professor of Assyriology in the University of Berlin.

**Delitzsch, Germany**, a town of Prussian Saxony, on the Lösser, 15 miles north of Leipsic. The manufactures are chiefly woolen goods; several important fairs are held each year. Pop. 9,560.

**Delius, dā-lē-oos, Nikolaus**, German Shakespearian critic: b. Bremen 19 Sept. 1813; d. Bonn 18 Nov. 1888. He studied philology at Bonn and Berlin, and in England and France. He settled in 1846 in Bonn, where he became extraordinary professor in 1855, and professor in 1863. He published a critical edition of Shakespeare (1854-61).

**Delivery**, in law (1) the delivery of a deed, or the handing of it over to the grantee, which is expressed in the attestation, "sealed and delivered," and is one of the requisites to a good deed. A deed takes effect only from this delivery; for if the date be false or impossible, the delivery ascertains the time of it. A delivery may be either absolute, that is, to the grantee himself, or to a third person, to hold till some conditions be performed on the part of the grantee. In certain cases, as wills, bonds made by a parent in favor of his children, or deeds in which the grantee has himself an interest, or where there is a mutual obligation between the parties delivery is not required. (See DEED.)

(2) An expression peculiar to England, also called jail delivery, a term applied to the sessions at the Old Bailey, London, or the assizes, when the jail is delivered or cleared of the prisoners.

**Delivery.** See OBSTETRICS.

**Della Crusca**, dēl'la krūs'kanz, a coterie of English poetasters resident about 1785 in Florence (and so named from the Accademia della Crusca of that city), who took to penning verses, which they published under the name of the 'Florence Miscellany.' Notwithstanding the inconceivable silliness and affectation of these productions they found numerous admirers. The newspapers of the day began to give publicity to their lucubrations. Genuine poetry seemed for a time at a discount, and nonsense and Della Crusca prevailed. The frenzy was, however, of short duration. The 'Baviad' (1794) and 'Mæviad' (1796) of William Gifford swept the butterfly Orlandos, Carlos, Lauras, Marias, "and

a thousand other nameless names" into merited oblivion.

**Della Maria, Dominique**, dōm-ē-nēk dē-lā mā-rē-ā, French musician: b. Marseilles 1768; d. Paris 9 March 1800. He was very precocious, but his fame rests upon the score he wrote for 'The Prisoner' by Duval.

**Della Robbia, Luca.** See ROBBIA, LUCA DELLA.

**Della Robbia Ware**, brown terra-cotta bas-reliefs thickly enameled with tin-glaze; made at Florence (chiefly in 1450-1530); in France (1530-67); so called from the name of the artist and its attributed inventor, Luca Della Robbia. The most important and largest work in this ware, perhaps, is the frieze on the hospital at Pistoia, made after the artist's death. At Tamworth, England, there is a plant, founded in 1847, that turns out this style of pottery, especially for architectural decorations, with great success.

**Dellys, dēl-lēz'**, Algeria, a seaport in the department of Algiers, 49 miles east of the city of Algiers. The inhabitants are mostly French and Arabs. It contains the mosque of the Mohammedans and the mission school of the Christians. The trade is principally in grain, oil, and salt. Pop. 3,987.

**Delmar, Alexander**, American political economist: b. New York 9 Aug. 1836. He established the 'Social Science Review' and was its editor in 1864-6. He is the author of 'Gold Money,' and 'Paper Money' (1862); 'Essays on Political Economy' (1865); 'Letter on the Finances' (1868); 'History of Money in Ancient Countries' (1884); 'The Science of Money'; 'The National Banking System'; 'Statistical Almanac'; 'The History of Money in America' (1899); etc.

**Delmonte y Tejada, Antonio**, ān-tō'nē-ō dēl-mōn'tā ē tā-hā'dā, Dominican historian: b. Santiago de los Caballeros, Santo Domingo, 29 Sept. 1783; d. Havana 19 Nov. 1861. He is the author of 'Historia de Santo Domingo' (1853), a history of the island from its discovery.

**Delolme, Jean Louis**, zhōn loo-ē dē-lōlm, Swiss writer: b. Geneva in 1740; d. Switzerland 16 July 1806. He at first practised as a lawyer in his native city, but the part which he took in its internal commotions obliged him to go to England, where he passed some years in great poverty. He became known by his once-celebrated but superficial 'Constitution de l'Angleterre,' translated by the author himself into English in 1772. Delolme also published in English his 'History of the Flagellants or Memorials of Human Superstition' (1783); an 'Essay on the Union with Scotland' (1796). He returned to Switzerland about 1775.

**De Lome, Enrique Dupuy**, ēn-rēk' dū pwē' dē-lōm, Spanish diplomatist: b. Valencia, Spain, August 1851. He became first secretary of the Spanish legation in Washington in 1882, and minister to the United States in 1892 and 1895. In February 1898 it was discovered by the authorities in Washington that he had written a letter to Señor Canalejas, a Spaniard of high rank who had been in the United States a short time previous supposably to make observations for the Spanish government. The letter, which followed Canalejas to Havana, and was

probably abstracted from his apartments there by some friend of the insurgents, contained disparaging phrases regarding the President of the United States, and otherwise plainly showed that neither the writer nor the recipient of it believed that Spain was acting in good faith with the United States government. De Lome at first denied the genuineness of the letter, but it was proved beyond a doubt that he was the author, and he telegraphed his resignation to Madrid on February 9.

**De Long, George Washington**, American naval officer and Arctic explorer: b. New York 22 Aug. 1844; d. Siberia 30 Oct. 1881. Graduating from the Naval Academy in 1865, he reached the grade of lieutenant-commander, and perished of cold and exposure while in command of the *Jeannette* Expedition in 1879-81. His journals have been published, entitled 'The Voyage of the *Jeannette*' (1883); and the story of the search for the survivors is told in Melville's 'In the *Lena Delta*' (1884).

**Deloo'**, an African antelope, one of the duiker-bok (q.v.).

**Delorme, Marion**, mā-rē-ōñ dē-lōrm, French courtesan: b. Blois 3 Oct. 1613; d. Paris 2 July 1650. Her beauty and wit soon made her house the rendezvous of all that was gallant and brilliant in Paris. The king, the princes of Condé and Conti, Buckingham, Cinq-Mars, St. Evremont, were among her admirers. The leading spirits of the Fronde regularly assembled in her house, and she is said to have assisted them in their enterprises. Mazarin was about to have her arrested when she died suddenly. The legend arose in France that the death and funeral were a mere pretense, got up to permit her to make her escape. She is said to have crossed over to England and married a rich lord, who shortly afterward died. She then returned to France, married a chief of brigands, who was captivated by the charms of his victim. After his death she married a procurator of finance in Franche-Comté, with whom she spent 22 years of her life. Upon his death prosperity forsook her. Plundered by adventurers and her own servants, she died in extreme poverty in 1706, or according to another story in 1741, at the age of 129 years. Victor Hugo has taken her as the subject of one of his dramas.

**De l'Orme, Philibert**, fē-lē-bār, French architect: b. Lyons 1515; d. Paris 8 Jan. 1570. He studied in Rome, aided by Cardinal de Ste. Croix, and became the favorite architect of Henry II. and Diane de Poitiers. On the death of Henry II. he remained in disfavor for some time. He began the Tuileries for Catharine de Medici. The Château d'Anet, begun in 1552, is one of his chief works. He wrote two books which were long a high authority on architecture.

**Delorme, Pierre Claude François**, pē-ār klōd frān-swā, French genre painter: b. Paris 28 July 1783; d. there 8 Nov. 1859. He was a pupil and imitator of Girodet. Among his works are: 'Death of Abel' (1810); 'Hero and Leander' (1814); 'Raising of Jairus' Daughter' (1817), in Church of St. Roch, Paris; 'Christ Reappearing' (1819), in Notre Dame, Paris; 'Cephalus Carried Off by Aurora' (1882), in the Luxembourg; 'Hector Reproaching Paris' (1824); 'Sappho Reciting an Ode to

Phaon' (1833); 'Eve Plucking the Forbidden Fruit' (1834); 'Magdalen at the Sepulchre' (1835); 'Adam and Eve After the Fall' (1839); 'Holy Family in Egypt' (1850).

**Delort, Charles Edouard**, shārl ā-doo-ār dē-lōr, French painter: b. Nîmes 4 Feb. 1841. He was a pupil of Gleyre and of Gérôme. Among his works are: 'Daphnis and Chloe'; 'The Stolen Cattle' (1866), Museum of Nîmes; 'Confidence'; 'Starting for the Chase' (1873); 'Marauders' (1874); 'Embarking of Manon Lescaut' (1875); 'After Breakfast' (1876); 'A Poacher'; 'Admonition' (1880); 'Capture of the Dutch Fleet by the Hussars of the French Republic' (1882); and 'Return from Exile' (1889).

**Delos**, dē'lōs (ancient ASTERIA; CYNTHUS; ORTYGIA), the central and smallest island of the Cyclades, in the Aegean Sea, a rugged mass of granite about two square miles in extent. Delos, according to old legends, was raised from the sea-bottom by Poseidon. It was then a naked rock floating about in the ocean, and was accidentally driven by the waves into the centre of the Cyclades. The Earth had promised Hera (Juno), with an oath, not to grant a resting-place to the fugitive Latona where she might be delivered. The unhappy goddess wandered restlessly over the earth until she perceived the floating island. As this was not stationary, it was not comprehended in the oath of the Earth, and offered her an asylum. Here Latona bore the infant gods Apollo (who was hence called *Delios*) and Artemis (who was called *Delia*). Both were worshipped on this island. Delos was thenceforth no longer the sport of the winds; it was moored to the bottom of the Aegean with adamantine chains by Zeus, and the fame of the isle spread over the world. Thus far mythological tradition.

At an early period the island, occupied by the Ionians, had kings of its own, who also held the sacerdotal office. In the course of time it came under the dominion of Athens. In 477 Delos became the common treasury of the league against Persia, but the money was afterward transferred to Athens. In 426 the Athenians purified Delos by removing all the tombs, and thenceforth they prohibited births and deaths from taking place on the island. In 422 they removed all the Delians from the island in order to complete its purification, but soon afterward these were allowed to return. After the destruction of Corinth the rich Corinthians fled thither, and made Delos the seat of a flourishing commerce. Delos had a famous temple of Apollo, built of Parian marble, and containing, besides the beautiful statue of the god, a remarkable altar, from which the Delian problem (Doubling the Cube), as it is called, had its name. The inhabitants, having consulted the oracle concerning the remedy of a plague which raged in Delos, were ordered to double the altar of Apollo, which was a cube. A solution of this problem of the duplication of the cube was attempted in different ways by several of the ancient mathematicians. The Grecians celebrated the Delian festival here every five years; and the Athenians performed annually the pilgrimage called *theoria*, with processions and dances. Delos was celebrated in ancient times for the number and the excellence of its artists, and workers in silver and bronze. Cicero, in his

oration for Roscius, has many eulogiums upon the fine vases of Delos and Corinth. Delos, called Dili or Sdili, is now without permanent inhabitants; a few shepherds from the neighboring islands pay it summer visits with their flocks. Some ruins of its former magnificence yet exist. Among these are remains of the Temple of Apollo above referred to, of one to Latona, of an amphitheatre, etc., besides a curious primitive temple of Apollo, called the Cave of the Dragon, which is not a real cave.

Since 1877 the French School at Athens has been making excavations on the island of Delos, largely under the direction of Théophile Homolle. The procedure has been slow and economical and the results excellent. Homolle, who previously carried on excavations at Delphi, was appointed by President Loubet director of the Louvre Museum. According to the report made to the Institut de France by Prof. Dürbach, Delos is the only ancient Greek city that remains approximately intact. It may almost be termed the Greek Pompeii in view of the scientific results which it has yielded. The complete plan of the sacred precinct of Apollo has been recovered; together with the theatre, the temple on Mount Cynthus, the temples of foreign gods, and an extensive part of the commercial section of Hellenistic and Roman days. Sculpture of all periods has been found in abundance, as well as inscriptions throwing light on various points of discussion. Joseph Florimund, Duc de Loubat (Papal nobility), an American, placed at the disposal of Homolle a yearly sum of \$10,000 to continue until the excavations are finished.

From the ancient mole, there is an approach to the precinct of Apollo through an avenue flanked by porticoes. The temple of Apollo is the centre of the precinct. It is a Doric work, with 13 columns at either side, and 6 in front and rear; and having comparatively few sculptural decorations. It dates from the early 4th century B.C. The decorative groups on the two gables have been in part recovered, and are now in the National Museum, Athens. To the north of the precinct of Apollo are large remains of the commercial Delos. In the 2d and 1st centuries B.C., Delos was the chief commercial town of the eastern Mediterranean. The most extensive building in this region is a kind of exchange, with a very large court encircled by apartments. The shore, facing Rhenea, is lined with docks and warehouses. A well of six metres in depth was found filled with tablets of marble and bronze, having upon them 20 ancient inscriptions regarded as of great value. The sanctuaries contain exvotos, stelæ, and inscriptions on marble and bronze giving in full detail accounts of the high priests and catalogues of the offerings brought by pilgrims. Streets, gardens, and sewage canalization may all be distinctly traced. Interesting private houses have also been discovered. Mention should also be made of the long and narrow hall, extending north and south and entered through a portico at its southern end, having at its northern end the famous "altar of horns," composed of the horns of the victims and accounted one of the seven wonders of the world. The entire building is often called "The Sanctuary of the Bulls," from the design of the capitals of the two columns separating the altar from the remainder of the hall. Consult Homolle, 'Les Archives de l'Intendance Sacrée de Délos'; Diehl, 'Ex-

cursions in Greece' (Eng. trans. by Perkins 1893); 'Bulletin de Correspondance Hellénique' (1877).

**Del'phi**, the seat of the most famous oracle of ancient Greece, was situated in Phocis, on the southern side of Parnassus. Apollo, according to fable, having killed the serpent Python, and determining to build his sanctuary here, perceived a merchant vessel from Crete sailing by. He immediately leaped into the sea in the form of an immense dolphin (Greek, *delphis*), took possession of the vessel, and forced it to pass by Pylos, and to enter the harbor of Crissa, not far from Delphi. After the Cretans had landed he assumed the figure of a beautiful youth, and told them that they must not return to their country, but should serve as priests in his temple. Inspired, and singing hymns, the Cretans followed the god to his sanctuary on the rocky declivity of Parnassus; but, discouraged by the sterility of the country, they implored Apollo to save them from famine and poverty. The god, smiling, declared to them the advantage which they would derive from serving as his priests. They then built Delphi, calling the city at first Pytho, from the serpent which Apollo had killed at this place.

The oracles were delivered from a cave called Pythium. Tradition ascribes its discovery to a shepherd who pastured his flocks at the foot of Parnassus, and was filled with prophetic inspiration by the intoxicating vapor which arose from it. Over the cave, which was contained in a temple, was placed the holy tripod, upon which the priestess called Pythia, by whose mouth Apollo was to speak, received the vapors ascending from beneath, and with them the inspiration of the Delphian god, and proclaimed the oracles (hence the proverb, to speak *ex tripode*, used of obscure sentences, dogmatically pronounced). After having first bathed herself, and particularly her hair, in the neighboring fountain of Castalia, and crowned her head with laurel, she seated herself on the tripod, which was also crowned with a wreath of the same, then, shaking the laurel tree and eating perhaps some leaves of it, she was seized with a fit of enthusiasm. Her face changed color, a shudder ran through her limbs, and cries and long protracted groans issued from her mouth. This excitement soon increased to fury. Her eyes sparkled, her mouth foamed, her hair stood on end, and almost suffocated by the ascending vapor, the priests were obliged to retain the struggling priestess on her seat by force; then she began, with dreadful howlings, to pour forth detached words, which the priests collected with care, arranged them, and delivered them in writing to the inquirer. At first the answers were given in verse, or were put into hexameters by priests of the temple who were poets, but in later times, the authority of the oracle being diminished, they contented themselves with delivering them in prose.

This oracle was always obscure and ambiguous; yet it served, in earlier times, in the hands of the priests, to regulate and uphold the political, civil, and religious relations of Greece. It enjoyed the reputation of infallibility for a long time; for the Dorians, the first inhabitants of the place, who soon settled in all parts of Greece, spread an unbounded reverence for it. At first only one month in the year was assigned for the



## DELPHI — DELPHIN CLASSICS

delivery of oracles; afterward, one day in each month; but none who asked the god for counsel dared approach him without gifts. Hence the splendid temple possessed immense treasures, and the city was adorned with numerous statues and other works of art, the offerings of gratitude. Delphi was at the same time the bank in which the rich deposited their treasures, under the protection of Apollo, though this did not prevent it from being repeatedly plundered by the Greeks and barbarians. Although the sanctuary and its treasures had been almost miraculously preserved from the Persians and Gauls, they were forced by Sulla to contribute to the payment of his soldiers, and Nero removed 500 brazen images from the sacred precincts. Constantine the Great enriched his new city by the sacred tripods, the statues of the Heliconian Muses, the Apollo, and the celebrated Pan dedicated by the Greek cities after the conclusion of the war with the Medes.

The ancients believed Delphi to be the centre of the earth: this, they said, was determined by Jupiter, who let loose, from the east and from the west, two eagles, which met here. The tomb of Neoptolemus (or Pyrrhus), son of Achilles, was at Delphi, and near it the famous Lesche, adorned by Polygnotus with the history of the Trojan war. In the plain between Delphi and Cirrha the Pythian games were celebrated. These national games, and the protection of the Amphictyons, gave Delphi a lasting splendor. It is now a village called Castri, near which the Castalian spring may still be seen.

In 1892 the site of Delphi, until that time occupied by the village of Castri, was purchased by the French government, a new village was established farther westward, and the French School at Athens, under the direction of Théophile Homolle, began important excavations. The entire precinct has been revealed, and, with the assistance of Pausanias' 'Itinerary,' many structures have been identified, including the altar, temple, stadium, theatre, treasuries, and other buildings. More than 3,000 inscriptions have been found, many of great value for Grecian history. The sculpture discovered contributes much to the history of art in the late 6th and early 5th century B.C. The ancient wall (the Hellenico), extending east and west, has been recovered in its entire length, and the two boundary walls, climbing the hill at either end of the Hellenico, have been traced. The main entrance was in the eastern of these two walls, and from this the Sacred Way proceeds by a zigzag course to the temple. Just within the precinct wall, on the northern side of the Sacred Way, stood the large building dedicated as an offering by the Lacedæmonians after the battle at Ægospotamos (q.v.). To the west, on the southern side of the way, was the Sicyonian treasury, in the form of a Doric temple, distyle *in antis*. Still farther westward, on the same side of the way, is the Cnidian treasury, originally a small marble Ionic temple, distyle, with a sub-structure of tufa. The sculpture from the pediment and frieze of this building, and the fragments of moldings, are of very considerable interest. The structure has been described as perhaps the most nearly perfect extant example of the transitional style of the early 5th century B.C. Here the Sacred Way makes a decided turn; and farther north, but still on the same side of the way, is the Athen-

ian treasury — a Doric temple *in antis*, of small size, with a basis bearing the remains of a dedicatory inscription which announces that it was built with the spoils from the battle of Marathon (q.v.). It was on stones in this treasury that the hymns to Apollo with ancient musical notation were found. Beyond this treasury was the many-fluted "Column of the Naxians," which supported the colossal marble sphinx, now in the museum.

The site of the temple shows the remains of various successive buildings. Many remains have been recovered of that built by the Alcmeonids (6th century), which was destroyed by an earthquake. Some archaic sculptures discovered have been assigned to the gables of this structure. The foundations now extant are those of the temple built in the 4th century. No definite information can be gained as to the oracle. The theatre, in the northwest corner of the precinct, dates from the early 2d century and is one of the best preserved in all Greece. The walls and seats of the auditorium remain; there are 33 tiers of seats arranged in seven sets, with a paved longitudinally-intersecting passage, or diazoma. Consult the 'Bulletin de Correspondance Hellénique,' and the 'Comptes Rendus de l'Académie des Inscriptions.'

Delphi, Ind., a city of Carroll County, of which it is the county-seat, about 20 miles southwest of Logansport, and 60 miles north by west of Indianapolis; on the Wabash River and the Louisville, New Albany, and Chicago, the Wabash, and other railways. The water-power is excellent. There are lime-works, the lime interests being extensive; besides paper-mills, wagon and carriage manufactories, flour and planing-mills, and a bent-wood factory. Pop. (1890) 1,923; (1900) 2,135.

**Delphin** (del'fin) **Classics** (*Auctores Classici in usum Serenissimi Delphini*), a collection of the works of the Latin classic authors, prepared by order of Louis XIV., at the suggestion of the Duke of Montausier for the use of the dauphin of France. The Duke of Montausier was the dauphin's governor, and in making a selection of authors, texts, and editors, employed the services of Bossuet, "the Eagle of Meaux," and Huet, bishop of Avranches, both preceptors to the young prince. This collection of the Latin classics does not comprise all the works of Latin writers that are extant, and it contains a few authors to whom the title classic can be given only by a very generous interpretation of the word. A notable omission of a genuine classic is the 'Pharsalia' of Lucan, which seems to have been dropped, as having no place in the library of the heir of an absolute monarch. The series was completed in 64 volumes 4to, including a 'Dictionary of Antiquities' in one volume. The text is accompanied by copious explanatory notes (in Latin), and, in the case of all poets and of difficult prose writers (Tacitus, for instance), by an interpretation in easier Latin. The same is done in the case of all difficult phrases occurring anywhere in the prose authors. The complete works of the several classics, as far as extant, are given; as well as the spurious works commonly attributed to them. A valuable feature of this collection is the very complete verbal index to the works of each author. In the years 1819-30



## DELPHINE—DELTA

Valpy, of London, republished the *Delphin Classics*, with the whole of the notes and interpretations, but usually with the texts as amended by later critical research. To the notes of the *Delphin* edition Valpy added very voluminous *Nota Variorum*. These last far exceed in bulk both the text and notes of the original *Delphin Classics*.

**Delphine**, děl-fën, a romance by Madame de Staël, published in 1802. Its bold imagery, keenness of observation, and power of impassioned description, perhaps justify 'Delphine's' position among the masterpieces of French literature. But neither situations nor characters are true to nature. The romance had a special interest for Madame de Staël's contemporaries, for several of the great men and women of the time appear in it under the thinnest of disguises. As in the case of "Corinne," the liberal ideas scattered through the story drew down on the author the anger of Napoleon, who ordered her to leave France.

**Delphin'ia**, a festival celebrated in honor of Apollo (Delphinios being one of his names) at Athens, on the 7th of the month Munychion (April). On this occasion a procession of girls bearing garlands, marched to the temple of the god to seek his favor more especially, perhaps, in the interests of seamen.

**Delphin'idæ**, the dolphin family of cetaceans. See DOLPHIN; NARWHAL; PORPOISE.

**Delphin'ium**, a genus of beautiful annual and perennial plants of the crowfoot family (*Ranunculaceæ*), with large irregular flowers, comprising about 60 species, natives for the most part of the north temperate zone; some few species are found in the mountains of Mexico. The name is a reference to the supposed resemblance to a dolphin. The genus is represented in America by about 25 species, which are known as larkspur, with blue or purple flowers, rarely white. The field larkspur (*D. consolida*) is found in waste places in southern New Jersey, Pennsylvania and farther southward, naturalized from Europe. It has for a companion at times (*D. Ajacis*) the cultivated larkspur, which has escaped from gardens. The cultivated plants have shorter spurs and longer and denser racemes of flowers. The tall larkspur (*D. urecolatum*) is found in the woods of central Pennsylvania, west to Minnesota, south to Nebraska, northern Alabama, and North Carolina. Other species extend the habitat of the genus, north to Manitoba and south and west to Texas. From the European (*D. staphisagria*, stavesacre) is extracted an alkaloid known as delphinine. The field larkspur is a simple astringent.

**Delphinus**, děl-fr'ñus (the dolphin), one of Ptolemy's original 48 constellations, situated between Vulpecula, Pegasus, Equuleus, Aquarius, and Aquila. It has no stars brighter than the third magnitude. The names Sualocin and Rotanev assigned to its stars Alpha and Beta, are merely reversals of the name Nicolaus Venator, an astronomer's assistant, who wished to commemorate himself.

**Delphos**, Ohio, city in Allen and Van Wert Counties, situated on the Miami & E. C., the N. O., the Pittsburg, Ft. W. & C., and other railroads; about 70 miles southwest of Toledo. The principal industries of the city are the Fort Wayne railroad repair shops,

and manufactures of furniture and wooden ware. Pop. (1900) 4,517.

**Del Rio**, děl rê'ô, Texas, county-seat of Vel Verde County; about five miles from the Rio Grande River; on the Southern Pacific Railroad. Its industries are those of an agricultural and stock-raising region, and it has several small cotton and wool manufacturing plants. Pop. (1900) 2,500.

**Delsarte**, François Alexandre Nicolas Chérie, frän-swä ä-lëks-ändr nîk-ô-lä shā-rê děl-särt, French educator: b. Solesmes 19 Dec. 1811; d. Paris 19 July 1871. He attained distinction as a tenor singer in the Opéra Comique, suddenly lost his voice, and thereafter applied himself to musical and dramatic instruction, having among his pupils many who afterward achieved operatic and dramatic celebrity. He was author of several melodies and romances, but his chief work was the elaboration of a system of dramatic expression, by which the voice and entire action of the body were trained by fixed rules. He aimed to make elocution a science. His system, at least in part, has of late been gaining many adherents among elocutionists.

**Delsarte Method**. See GYMNASICS.

**Delta**, the name of the fourth letter of the Greek alphabet, the capital form of which is an equilateral triangle. The name is also applied to a tract of land triangular in shape, generally formed by the deposit of river sediment, especially at the mouths of rivers which flow into lakes or seas. A mountain stream changing the force and rapidity of its current upon entering a level plateau deposits at the base of the mountain sediment which assumes the triangular form and is called a cone-delta or a fan-delta, or an alluvial fan.

The nature of the current in the body of water receiving the river deposit has much to do with the size of the delta. A swiftly-flowing current or high tides carry off the deposit from the shore line, sometimes forming long coast islands or sand-bars or sand-spits, or distributing the sediment over the ocean bed; but slowly moving waters are conducive to large deltas. The almost tideless Mediterranean and Gulf of Mexico have deltas at the mouths of the large rivers which bring deposits to the sea. Usually the finest particles of land waste are swept away by currents, but the rest accumulates at the mouth of the river and builds up a fan-shaped land mass, or delta, in front of the old shore line. Old rivers that bring down much sediment, may, if the coast is neither uplifted nor depressed, build deltas of great size. In the case of a river emptying into a sea even the fine waste brought down falls to the bottom before long, as the salts in the sea water precipitate matter in suspension. The river usually enters the sea over the front of its delta by several channels, these branches of the main stream being called distributaries. An excellent example is the way the Mississippi divides up at its mouth. As a large river bringing down waste can build a delta even where waves and tidal currents are active in distributing the material, the absence of a delta at the mouth of a large river indicates generally some recent change of level. Thus the absence of deltas along the Atlantic coast of the United States is due to a slow depression of the coast, still in progress. This submergence of the coast has

## DELTA METAL—DELUGE TABLET

a tendency to create estuaries at the mouths of rivers. Some notable deltas are those of the Po, Hoangho, Ganges, and Niger. As showing how rapidly a delta may grow, Adria in Italy was a seaport in the time of Augustus, but the growth of the Po delta has left it 20 miles inland. The Mississippi delta is advancing into the Gulf of Mexico at the rate of one mile in 16 years. The Mississippi delta is, in area, about 12,500 square miles; that of the Nile about 10,000 square miles. Large rivers frequently change the channel of their distributaries, thus making the deltas unsafe for dwelling places. Consult: Geikie, 'Elementary Lessons in Physical Geography,' and 'Text Book of Geology'; Tarr, 'Physical Geography.'

**Delta Metal**, an alloy containing 56 parts of copper, 42 of zinc, and 2 of iron. It is said to be as strong as mild steel, over which it has the advantage of not rusting by exposure to the weather. Delta metal is largely used in England and Germany, and is also employed in the United States, though to a more limited extent.

**Delta Territory**, Venezuela, the delta of the Orinoco River, bounded on the north and east by the Gulf of Paria, the Atlantic Ocean, and British Guiana; on the south by the Yururari territory; on the west by the Maturin section of the old state of Bermudez (now divided into states of Barcelona and Sucre). Its numerous streams and low-lying coasts are not well adapted to navigation of large vessels. Pedernales, a small town on the Gulf of Paria, is the capital. Pop. of territory about 2,500.

**Deltoid Muscles.** See **MUSCLES**.

**Deluc, Jean André**, zhōñ äñ-drä dé-lük, Swiss geologist and meteorologist: b. Geneva 8 Feb. 1727; d. Windsor, England, 8 Nov. 1817. He passed the first half of his life in commercial pursuits. In 1773, obliged by commercial disaster to quit his native city, he went to England, was elected a Fellow of the Royal Society of London, and appointed reader to the queen, a situation he held for 44 years. He made numerous geological excursions in central Europe and in England, of which he has published accounts. He enriched science with very important discoveries. Among his numerous writings are his 'Recherches sur les Modifications de l'Atmosphère' (1772); 'Nouvelles Idées sur la Météorologie' (1786); 'Traité élémentaire de Géologie' (1810).

**Deluge** (through the French, from Lat. *diluvium*, "a flood"). There is scarcely any considerable race of men among whom there does not exist, in some form, the tradition of a great deluge, which destroyed all the human race except their own progenitors. The classical story of Deucalion and Pyrrha is but a typical example of similar myths found everywhere, and savages and fathers of the Church alike have argued that the shells, corals, and other marine objects often found on the tops of mountains, offered distinct proof of the historical reality of a deluge. That the Noachian deluge recorded in Scripture covered the whole earth and destroyed all mankind save one family, was the universal opinion until toward the close of the 18th century. The organic remains, on which the science of palæontology is now founded, were regarded as its wrecks, and were held to prove that it had covered every known country, and risen over the highest hills. In the progress of geol-

ogy, it soon became evident that most of the stratified rocks demanded an earlier origin than a few thousand years, and the influence of the deluge was consequently restricted to the slightly altered superficial deposits; but many of these were, after a few years, found to belong to a period vastly anterior to any historical epoch, and to have been produced by long-continued and persistent agencies, differing totally from a temporary cataclysm. The more common modern opinion regards the flood of Noah as partial and local, although the universality seems fairly enough to be implied in the biblical description, and although the old theory has been revived by writers of some authority, other noted men have argued and maintained the partial character of the flood from the absence of all record of a deluge among the black races of the world, as the negroes and Papuans, asserting that this opinion is quite consistent with the exegesis of Scripture, with tradition, and the doctrine of the Church, while it is the only theory that avoids all the ethnological and linguistic difficulties presented by the existence of the great negro and yellow races marked off so distinctly from the Noachian type. The deluge traditions of many primitive races are connected with religious mysteries, and it is scarcely true, as has often been asserted, that it is the Old Testament alone that gives a moral reason for the deluge sent upon the world. The Chaldean account discovered by George Smith presents a striking resemblance to the Genesis story, and agrees with it also in making the flood distinctly a divine retribution for human sin, although it of course differs from the Jewish account in being polytheistic instead of monotheistic. The vessel in which Xisuthros, the Chaldean Noah, sails, is a ship guided by a steersman, and others beside his own family are admitted into it. The flood is seven days at its height, and Xisuthros sends out in succession a dove, a swallow, and a raven. The ship finally rests on Rowandiz, the highest mountain of eastern Kurdistan, and the peak which supports the heavens, instead of upon Ararat, the northern or Armenian continuation of the range. Babylonian tradition also confounds Noah with Enoch, for Xisuthros is taken to the skies immediately after coming out of the ark. Two deluge poems were amalgamated together in an Akkadian epic, in 12 books, describing the adventures of Gizdhubar.

**Bibliography.**—Buckland, 'Reliquiæ Diluvianæ'; Howorth, 'The Mammoth and the Flood'; Lenormant, 'Histoire Ancienne de l'Orient'; Motais, 'Le Déluge Biblique.' Compare: Sayce, 'Fresh Light from the Ancient Monuments'; Prestwich, 'On Certain Phenomena Belonging to the Close of the Last Geological Period.'

**Deluge Tablet, or Deluge Tablets**, the name given to the tablet or tablets (the 11th of the Izdubar Legends) inscribed with cuneiform writing, which being translated is found to contain the Chaldean account of the deluge. Perhaps it may have been originally Acadian. A paper on the subject was read by George Smith, of the British Museum, before the Society of Biblical Archaeology, on 3 Dec. 1872, and a revised translation published in 1874. What Mr. Smith called the Flood-hero was Adra-hasis. In Babylonian proper names compounded of two elements, either might at pleasure be placed first.

Reversing the relative positions of the two elements, the name becomes *Hasis-adra*, which being imperfectly heard by the Greeks was by them written *Xithurus* or *Xisuthrus*.

**Delun'dung** (native name), the *linsang* or weasel-cat (*Prionodon gracilis*), a small quadruped inhabiting the vast forests of the eastern extremities of Java and Malacca. It is of pale yellowish-white color, with elegantly marked stripes and bands of a deep brown. It is allied to the civets, but is destitute of a scent-pouch.

**Delusions.** A delusion is a mental state in which the mind, reasoning from definite facts, arrives at erroneous, undemonstrable, and perhaps foolish conclusions, and is unable to modify these conclusions, whatever proof may be brought to show their falsity. Thus a patient suffering from delusions may read into the actions of others ideas and conclusions relating to himself that have no basis in actual logic. Seeing several people on a corner, a man with persecutory delusions may infer that they are gathering to do him harm; hearing people talking, he imagines they are talking about him, and planning to deprive him of his liberty, his money, his life, etc. See **INSANITY**.

**Delyannis**, *dēl-i-ān'is*, Theodoros, Greek statesman: b. Kalavryta, Peloponnesus, 1826. He entered politics early in life and in his long career has held many cabinet positions. While prime minister for the third time, 1895-7, he brought about the Greco-Turkish war, whose disastrous result obliged him to resign with his whole cabinet.

**Demades**, *dēm-ā'dēz*, Athenian orator: d. 318 B.C. Originally a fishmonger, he rose to high places in the republic. He was captured by Philip of Macedon in the battle of Chæronea, but soon set at liberty. He afterward exerted his influence in favor of the Macedonian party at Athens, but betraying Antipater, was put to death by Cassander, the son of the latter.

**Demagogue** (Gr. *demagogos*), one who leads or directs the people in political matters. In its original acceptation it was considered an honorable designation, and in this sense Pericles, Demosthenes, and Cicero were demagogues. On the other hand, the tanner, Cleon, satirized by Aristophanes in his play of the 'Knights,' is a portrait of the personage to whom the epithet in its bad sense is applied. It is a handy nickname to throw at a popular politician with whose views you have no sympathy. Usually an unprincipled orator or political agitator who curries popularity and power with the masses by pandering to their ignorance or prejudice.

**Demand**, a term in law, of comprehensive meaning. When referred to contracts it means a claim, a legal obligation. Its correlative is release, and a release of all demands is a release of all covenants real and personal, whether the conditions are broken or not, of all annuities, recognizances, obligations, and contracts. Demand, in the practice of law, is a requisition made by one individual to another to do a particular thing, namely, pay some debt, fulfil some contract, release some person or property. Demands are either express or implied. Sometimes an express demand is required before action can be taken, in other cases the law requires no more than the demand implied by bringing an action. Whether an express demand is required

before a plaintiff can commence action to enforce fulfilment of a contract depends upon the express or implied stipulations of the parties to the contract. When no date is given in a contract for its fulfilment, whether in the case of a promissory note, or in the contracting of a debt, the payment of the obligation is due on the present day, or immediately on demand. It is requisite, in some cases arising *ex delicto*, that is, in some criminal cases, to make a demand for the restoration of the right before the commencement of an action, or, for instance, when the wife or other member of the plaintiff's household has been enticed away, in order to constitute the party a wilful wrongdoer, a demand for restoration must be made. When property lawfully obtained possession of is unlawfully detained, or converted, a demand for the delivery of its possession to the owner is requisite before an action can be laid. When an order to pay, or to do something has been made a rule of court, a demand for the payment of the money, or performance of the thing must be made before an attachment will be made for contempt. In like manner, before action can be taken for breach of promise of marriage, a demand for marriage must be made by the plaintiff, unless the defendant has married another person, or has refused to marry at any time. See **CONTRACT**; **RECOGNIZANCES**; **RELEASE**.

**Demand and Supply**, in political economy, the desire for services or utilities on the one hand, and the production or offer of them on the other, which tend to complete an act of exchange. Demand is commonly said to be relative to supply, but in reality it is reciprocal to it. Certain political economists qualify the term demand by the word effectual, but it is scarcely necessary to make such a limitation. A mere desire for objects has no commercial significance, but that desire simply which contemplates a mutual benefit. Thus the wish of a beggar to possess a diamond cannot affect the price of the article, as he can offer no desirable object in return. The intensity of demand, and the consequent effect upon values, will be proportionate to the necessity which exists for satisfying the demand. Different rules, therefore, will apply to the increase of price consequent upon increased demand and reduced supply in articles of voluntary use, and to the same rise in price when affecting articles of necessary use. The demand for the latter class of utilities is constant, and a deficiency in supply cannot be met by abstinence, except to a scarcely appreciable degree, whereas any considerable deficiency in the supply of articles of voluntary use is to some extent met by economy. Prices will, therefore, increase in different ratios according to the degree in which the commodities demanded are necessary or convenient. Thus the price of grain may rise, in the case of a bad harvest, from 50 to 100 per cent; cotton or wool, in similar circumstances, would certainly fluctuate, but not to anything like the same extent; wine would vary in price least of all; the deficiency in the last two commodities being artificially restored by the decrease of demand consequent on economy and abstinence. See **POLITICAL ECONOMY**.

**Demar'atus**, Spartan king. He succeeded his presumed father, Ariston, about 510 B.C.; but lost the throne, partly in consequence of a quarrel with his colleague, Cleomenes, and partly

## DEMARICATION — DEMBINSKI

on account of doubts which had been cast upon his real parentage. He retired into private life; but having afterward become a magistrate, was sitting in that capacity at the Gymnopædian games when Leotychides, who had supplanted him as king, sent tauntingly to ask him how he felt in a secondary place after having occupied the first. The boldness of his reply forced him to take flight, and he passed over into Asia, where he was well received by Darius. He afterward accompanied Xerxes on his expedition against Greece, and is said to have given counsel which, if listened to, would probably have made the issue of it very different from what it eventually proved.

**Demarcation, Line of**, the boundary established 4 May 1493 by Pope Alexander VI., who assigned to Spain all the lands she had discovered or might discover west of a line running from the North pole to the South, distant 100 leagues west of "any of the" Azores and Cape Verde Islands (provided such lands had not been in the actual possession of any other Christian king or prince up to the preceding Christmas), and to Portugal, on the same conditions, all the territory she had discovered or might discover east of the said line. The governments of the peninsula held that the Pope had sole and absolute authority to dispose of all countries inhabited by heathen peoples; moreover the papal bull *inter cetera* of 4 May 1493, under penalty of excommunication, forbade all persons without special permit to go "for the purpose of trade or any other reason" to the islands and mainlands thus granted exclusively to Spain and Portugal. After this territorial concession had been made, Portugal's possessions in the eastern hemisphere were called the East Indies, and those of Spain in the western hemisphere were called the West Indies. An extension of the papal gift of the Indies was made in the bull dated 25 Sept. 1493. A dispute arising in regard to the position of the line of demarcation, the two countries concerned sent commissioners to the Spanish city of Tordesillas, and on 7 June 1494 the commissioners agreed that the line should pass, north and south, 370 leagues west of the Cape Verde Islands. On the strength of this agreement, Portugal claimed and secured the eastern part of South America (see BRAZIL). After the Victoria returned to Seville (1522) from her voyage to the Moluccas, and so round the world, the Portuguese accused their rivals of having broken the treaty of Tordesillas. The Spaniards in reply said that the Spice Islands (Moluccas) were not within the limits of the Portuguese territory. To settle this important dispute, a congress was convened at Badajos in 1524. Commissioners of both countries were in attendance—Fernando Columbus, Sebastian Cabot, and others. The two main points to be decided were: (1) whether the line of demarcation should be drawn at the stated distance west of the western or eastern limit of the Cape Verde Islands; and (2) where it would pass on the opposite side of the earth. This Badajos junta failed to come to an agreement "owing to the Portuguese experts, who could not overcome this dilemma: If the line was pushed more to the west, Portugal would gain a greater part of Brazil; but she might lose all rights over the Moluccas, as the line, of course, had to be carried to the other hemisphere as well." The treaty of Vitoria, signed

19 Feb. 1524, provided that, inasmuch as some doubt existed between the sovereigns of Castile and the king of Portugal as to the possession and ownership of the Moluccas, there should be appointed by each one of the parties to the treaty "three astrologers and three pilots, and sailors, for the determination of the demarcation." A treaty negotiated at Saragossa and signed by representatives of the Spanish and Portuguese monarchs 22 April 1529 fixed the line of demarcation 297½ leagues east of the Moluccas, Spain selling for a stated sum whatever rights she had formerly claimed to possess in the Spice Islands, and agreeing for the future practically not to colonize, and expressly not to "trade there in any manner whatsoever." It did not seem necessary at that time to raise the question as to the location of the line in the New World, though it is plain that if the circle thus "determined from pole to pole" in the east had been logically completed, Portugal would have been excluded from the South American continent. The bearing of this matter upon Spanish rights in the Philippines is of special interest. The Molucca Islands, the Philippines, and, indeed, the western half of Australia lay within the Portuguese assignment, as a matter of fact. Therefore the principal Spanish settlements and explorations in the Far East appear to have been made in contravention of Portugal's treaty rights.

Consult: Blair and Robertson, 'The Philippine Islands,' Vol. I.; Harris, 'The Diplomatic History of America'; Dawson, 'The Line of Demarcation of Pope Alexander, etc.' . . . with an inquiry concerning the Metrology of Ancient and Medieval Times,' in Proceedings of Royal Society of Canada, 1899.

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**Demavend**, dēm-a-vēnd', a volcanic mountain, now extinct, of Persia, and the highest peak of the Elbruz chain, 45 miles south of the Caspian Sea, and about 40 miles northeast of Teheran. Its height, according to the most reliable measurement, is 18,464 feet. At a distance the mountain has the form of a smooth cone, and appears to slope evenly from top to bottom at an angle of 45°. The cone terminates in a crater of 85 yards in diameter, and nearly surrounded by jagged rocks, composed partly of basalt and partly of limestone and sulphur. This sulphur is an article of commerce. The basin within is almost entirely filled with snow. Around the base are many hot springs. William T. Thompson was the first European to ascend Demavend (1837).

**Dembea**, dēm'bē-a or dēm-bē'a, or Tzana, a lake of Abyssinia, in the western part of the country. It is about 50 miles long and 6,000 feet above the level of the sea. It contains many islands, one of which is a place of confinement for state prisoners. The Bahr-el-Azrek, the Abyssinian Nile, flows through it.

**Dembinski**, dēm-bēn'skē, **Henryk**, Polish general: b. Strzalkow, near Cracow, 3 May 1791; d. Paris 13 June 1864. In the year 1825 he became a member of the Polish diet, where he cast in his lot with the opposition party. On the outbreak of the revolution in that country (1830), he was made brigadier-general, and in the following year was nominated governor of Warsaw and commander-in-chief of the Polish army. On the fall of Warsaw in September

into the hands of the Russians, Dembinski made his escape. The Hungarian revolution of 1849 once more offered him a field for his activity, and he was appointed by Kossuth commander of the insurgent troops. He had the misfortune to lose the battle of Kopolna, and resigned his command, but consented to act under Görgei. After the capitulation signed by the latter at Villagos, and the resignation of Kossuth, Dembinski fled to Turkey.

**Deme**, *dēm*, a subdivision of ancient Attica and of modern Greece. The *dēmoi* were townships or hundreds, subdivisions of the *phulai*, and were equivalent to the Dorian *komai*, Latin *pagi*. The word really meant a country district, or a common name for divisions of the country, and in the time of Herodotus they were 100 in number in Attica (10 in each *phulē*), afterward 170; their origin was commonly referred to Theseus. The word *dēmos* early came to be applied to the commons, and survives significantly in our democracy and demagogue.

**Dementia**, a mental condition in which there is a breaking down or weakness of what originally was a competent mind. Dementia is usually a secondary condition, although primary and secondary forms are distinguished by alienists. Primary or acute dementia usually follows some violent physical or mental shock, which may paralyze the brain functions for a time or for life. Secondary dementias are those that follow other forms of the insanities, or are the result of senile changes. Acute primary dementia occurring in young adults is now spoken of as dementia *præcox*. The most characteristic symptoms are a somewhat vacant and expressionless face; confused memories, or loss of memory; excitement, which may alternate with periods of stupor; diminished sensibility to pain; loss of desire to eat, or else gluttony; incoherent thinking; stumbling, or muttering speech, or speechlessness; lowered reflexes, etc. Some patients may recover partially, but the usual history is that they remain permanently demented and pass into secondary demented states. Chronic dementias, it has been said, usually follow attacks of mental disease, which, as Maudsley says, "instead of passing away in their due season and leaving a clear mind, lapse by quick or slow steps of degeneration into terminal dementia. Comparative peace remains then, but it is the peace of a desert." Alcoholism, epilepsy, apoplexy, and nutritional changes all bring about chronic dementia. See **INSANITY**.

**Demerara**, *dēm-ê-râ'ra*, The District of, one of the three parts into which British Guiana is divided. In the uplands coffee is produced, and in the lowlands sugarcane and rice; these being the principal articles of exportation. The capital of this district and of the colony as well is Georgetown, which sometimes is also called Demerara.

**Demerara River**, British Guiana, rises in the unexplored mountains of the interior, flows northward, and empties into the Atlantic at Georgetown. It is navigable for small vessels to a point about 150 miles above its mouth. The estuary of the Demerara forms a moderately good harbor. See **GEORGETOWN**.

**Demesne**, *dē-mēn'*, or **Domain** (in French *domaine*), in its popular sense, denotes, under a feudal aristocracy, the lord's domain, his

manor place, with the lands thereto belonging. In England the demesne of the crown denotes either the share reserved to the crown in the distribution of landed property at the time of the Conquest, or such as came to it afterward, by forfeitures or other means. They are at present contracted within a very narrow compass, having been almost entirely granted to private subjects. The rents and profits of the demesne lands of the British crown are no longer kept separate, but are incorporated with the ordinary revenue. See **CIVIL LIST**.

The alienation of the domains in France, rendered necessary to reward powerful supporters, was the main cause of the fall of the Carolingian dynasty. The succession of the Capets was likewise due to their great possessions, which rendered them the most powerful nobles in France. The policy of this house, particularly of Louis XI. of the Valois branch, in despoiling the great nobles, made them at length absolute masters of the kingdom, although at first their authority, beyond their own domains, was very feeble. The despotic power of the French monarchy reached its climax under Louis XIV., the most powerful of the Bourbon branch of the family. The nobility had now lost nearly all its feudal privileges, and could easily be rewarded by places at court, appointments in the public services, and pensions out of the national revenue. Napoleon, who endeavored as much as possible to revive the traditions and institutions of the monarchy, had also a *domaine extraordinaire* (law of 30 Jan. 1810), which consisted of his acquisitions by conquests, and were kept entirely at his disposal; these supplied the means of donations to his generals, etc. The *domaine extraordinaire* was likewise retained by the Bourbons (law of 22 May 1816). The administration of these donations was conducted with great wisdom; and Napoleon, as Las Casas relates, dwelt with pleasure on this branch of his government.

**Demeter**, *dē-mē'tēr*, one of the twelve principal Grecian deities, the great mother-goddess, the nourishing and fertilizing principle of nature. She was the daughter of Cronos and Rhea, and mother of Persephone (often called Cora, the Maiden, the Proserpine of Roman mythology), and according to Hesiod, of Dionysus (Bacchus). By later writers Demeter is represented as being the wife of Dionysus. The main feature in the mythus of Demeter, and that which forms the fundamental idea of her worship, is the loss and recovery of her daughter, Persephone. Zeus, without the knowledge of Demeter, had promised Persephone to Pluto, who carried her off as the earth opened in a field where Zeus had caused some flowers to grow to tempt the unsuspecting maid. Her mother, who heard the echo of her cries, but did not see who had carried her away, sought for her in vain over the earth, till Helios told her that Pluto had carried her off with the connivance of Zeus. Demeter vowed never to return to Olympus until her daughter accompanied her. Zeus sent first Iris, and then all the gods, to implore her to return, but without success; at last, fearing lest the race of mortals should perish, she having afflicted the earth with sterility, he despatched Hermes to Erebus to bring back Persephone. Pluto consented to her return, but gave her a pomegranate, and she



having eaten of the fruit of Erebus, was compelled thenceforth to spend a part of every year in the infernal regions. Hermes conducted her to her mother at Eleusis, and Zeus sent Rhea to urge Demeter to revisit Olympus, and tell her that he had consented that Persephone should remain two thirds of the year with her mother, the remaining third (the winter season) being passed with Pluto. Demeter now consented to return and to restore fertility to the earth; but before departing from Eleusis, which she had made her abode, she taught Triptolemus how her worship was to be conducted, and initiated him into the mysteries of the Eleusinia. In ancient monuments Demeter is represented as a beautiful matronly woman, with a mild and benevolent expression of face; she is always enveloped with ample drapery, which is usually close up to the neck; sometimes, however, one of her breasts is left exposed. Prof. Max-Müller identifies her with the Sanskrit *Dyâvâ Mâtar* (the Dawn). By the Romans she was identified and worshipped with Ceres (q.v.).

**Demeter, Dimitrija, dē-mē-tr'zhā dē-mē'tēr**, Croatian dramatist and poet: b. Agram 21 July 1811; d. there 24 June 1872. His principal dramas are: 'Love and Duty'; 'Blood-Revenge'; and the tragedy 'Teuta.' He wrote a lyro-epic poem, 'The Battlefield of Grobnik,' and several stories. He translated several foreign dramatic works into Croatian.

**Deme'trius I.**, surnamed **Poliorcetes**, king of Macedonia: d. Pella, Syria, 284 B.C. He appeared before Athens with a fleet, and restored to the people their ancient form of government (307 B.C.). Having lost the battle of Ipsus against Seleucus, Cassander, and Lysimachus (301 B.C.), he fled to Ephesus, and passing over to Corinth, embarked on an expedition against the Thracian dominions of Lysimachus. He then went to Asia, to bestow his daughter Stratonice in marriage on Seleucus, and on his way took possession of Cilicia, by which his friendship with Seleucus was broken off. He conquered Macedonia (294 B.C.), and reigned seven years, but lost this country by his arbitrary conduct.

**Demetrius II.** (called "Nicator"), king of Syria: d. 126 B.C. Ptolemy Philometer, king of Egypt, placed him on the throne of his father, after expelling the usurper, Alexander Balas, 146 B.C. He married Cleopatra, the wife of the same Alexander, and daughter of Ptolemy.

**Demetrius**, or **Dmitri**, a series of impostors who usurped supreme authority in Russia, and led to some of its remarkable revolutions. Ivan Wasiliewitch, who had put his eldest son to death, left the throne in 1584 to another son, Fedor, whom Boris Godunow entirely supplanted in his authority. Ivan had left another son, Dmitri, by a second marriage; and Boris, fearing that he might one day prove a formidable obstacle to his ambitious projects, made away with him, but no one exactly knew how. Shortly after, in 1598, Fedor died, and Boris took possession of the throne. Mystery still hung over the fate of Dmitri, and Grishka, or Gregory Otrepieff, determined to turn it to account. Several persons had been struck with his resemblance to Dmitri, and he at once explained the fact by declaring that he was Dmitri indeed, and that the design of Boris to murder him had been frustrated. The report quickly spread, and

Otrepieff fled into Poland, where Sigismund III., king of Poland, who saw in him a useful instrument for introducing Polish influence into Russia, aided him to enter that kingdom at the head of a body of troops. Boris was deserted by his soldiers, and ended his life by poison. Otrepieff in 1605 entered Moscow in triumph, and, as the genuine son of Ivan, was proclaimed grand duke of Russia. He was now firmly seated on the throne, and might have transmitted it to his descendants had he governed with prudence. Conspirators, after exciting a tumult, forced their way into the palace and put the false Dmitri to death. His body was exposed to public view, but in such a state that its features could not be recognized; and a rumor of his being still alive having spread, another impostor quickly appeared to personify him. The Poles espoused the cause of the second false Dmitri, and had made it triumphant, when he was assassinated in 1610 by the Tartars whom he had selected as his body guards. A state of anarchy ensued, and continued for nearly half a century, during which a number of other false Dmitri appeared in different quarters.

**Demetrius Phalereus**, fa-lē'rē-ūs, Greek orator. He was made Macedonian governor of Athens, and archon (309 B.C.), and embellished the city by magnificent edifices. The gratitude of the Athenians, over whom he ruled, erected him as many statues as there are days in the year, but these were afterward scornfully broken, and he himself condemned to death by that fickle people. He fled to Egypt, where he is said to have promoted the establishment of the Alexandrian Library, and of the museum, the superintendence of which Ptolemy Lagus entrusted to him. Under Ptolemy Philadelphus, he fell into disgrace, and was banished to a remote fortress, where he died from the bite of an asp. Demetrius was among the most learned of the Peripatetics, and wrote on several subjects of philosophical and political science. But the work on rhetoric, under his name, belongs to a later age.

**Demetz, dē-mās, Frédéric Auguste**, French philanthropist and prison reformer: b. Paris 12 May 1796; d. there 22 Nov. 1872. He was judge, vice-president of the chamber of correctional police, and court counselor. He founded in 1840, the penitential and agricultural colony of Mettray for juvenile delinquents, devoting himself wholly to this establishment, which has served as a model in France and elsewhere. He was elected corresponding member of the Academy of Moral and Political Sciences, Paris, in 1864. He wrote many essays and reports upon penitentiary methods and reforms.

**Demi Lune** (same as ravelin), in fortification, is a work constructed to cover or protect the curtain or wall of a place, and the shoulders of the neighboring bastions. It is composed of two faces forming a salient angle toward the open country outside the place. It has two demi-gorges formed near the counterscarp, and is surrounded by a ditch.

**Demi-monde**, dēm'ī-mônd, an expression first used by the younger Dumas in a drama of the same name (first performed in 1855), to denote that class of gay female adventurers who differ from honest women in being the objects of public scandal, and from courtesans by their non-venality. When the word is used elsewhere



than in France the last-mentioned difference is seldom kept in mind.

**Demi-relief**, or **demi-rilievo**, *rĕ-lĕ'vō*, a term applied to sculpture projecting moderately from the face of a wall; half raised, as if cut in two, and half only fixed to the plane. **Mezzo-rilievo**, which is the more correct term used to designate this style of sculpture, is lower than alto-rilievo and higher than basso-rilievo.

**Demidoff**, *dĕm'ĕ-dōf*, or **Demidov**, a noble Russian family, whose head, Nilka Demidoff, was an armory-founder at Toula. This Demidoff was intrusted by Peter the Great with the business of casting the cannon for that prince's numerous warlike expeditions. He actively seconded all the exertions of the czar, and in 1725 discovered the mines of Kolyvan, the working of which speedily enriched him. He left a son, Nitika, and several grandsons, who distinguished themselves in the same career as their progenitor, and amassed colossal fortunes. The best known of these are Prokop Demidoff, who worked with great profit the iron, copper, and gold mines of the Ural Mountains; Nikolai Nikitich (about 1773-1828), a zealous philanthropist, who introduced into his country several branches of industry, founded establishments of public utility, and carried to a great state of perfection the working of mines. He had an annual income of more than \$1,000,000. His last years he passed in France and Italy, enjoying the society of learned men, and heaping benefits on all around him. He left two sons, Paul and Anatole (1812-70), who, as well as inheriting his fortune, had also the same high taste and benevolence.

**Demijohn**, a jug in a wickerwork casing or box. The name naturally suggests "half-John," or somebody or something directly or indirectly connected with some "John" and liquor. But demijohns are used for holding all sorts of liquors—not necessarily intoxicants.

The origin of the word is uncertain. We get it from the French "*damejeanne*," which signifies a "demijohn," just as in our language. And that word appears to have been originally a corruption of "*Dame Jeanne*," or Lady Jane—or else to have gone into the French tongue directly from the Arabic "*damagan*" (a demijohn), said to be so called from Damagan, a town in Khorasan, a northern province in Persia, once famous for its glass-works, and to have been the spot where glass jugs enclosed in wickerwork were originally made.

The demijohns themselves are a most important article in the liquor, oil, drug and paint trades, not to mention other branches generally not so well known. The largest demijohn regularly made for the trade has a capacity of five gallons. The smallest holds 1½ ounces, or less than a gill. This size is used chiefly for perfumery and cordials. Between the five-gallon and the gill size demijohns are made in many sizes, including quarts, pints and half-pints. Demijohns are not very costly, but the very smallest are the most expensive proportionately. A gill demijohn sells for more than one that will hold half a gallon, the reason being that the little ones must be covered and finished with great care, while in the larger sizes the chief thing required is serviceability. For the basket work on the smaller demijohns takes more time and costs more for labor than a demijohn some

sizes larger. Demijohns are used for many purposes. They are filled with vinegar, molasses, perfumery, bay rum, cordials, extracts, essences and for various waters. Almost all the demijohns used in America are made here, though some are imported from Germany and France. Before sending them to this country they pack their big demijohns in cork scraps, or shredded sponges for their protection and transportation. Our big five-gallon demijohns are made in the form of box-demijohns, the bottle being incased not in wickerwork, but in a box, or a wooden crate. Sometimes smaller ones are made in this way. The big demijohns are known as carboys and are regularly employed to transport chemicals.

**De Mille, Henry Churchill**, American playwright: b. North Carolina about 1853; d. Pompton, N. J., 10 Feb. 1893. He was graduated at Columbia College, and was by turns preacher and teacher till 1882, when he became examiner of plays at the Madison Square Theatre, and later for a short time an actor. His first successful play was the "*Main Line*," in which he collaborated with Charles Barnard. In 1887, having become associated with David Belasco, he wrote the well-known society dramas: "*The Wife*" (1887); "*Lord Chumley*" (1888); "*The Charity Ball*" (1889); "*Men and Women*" (1890). His last work was a melodrama adapted from the German, entitled "*Lost Paradise*," which was successfully produced in 1892.

**De Mille, James**, Canadian novelist: b. St. John, N. B., Aug. 1837; d. Halifax, N. S., 28 Jan. 1880. Graduated at Brown College in 1854. He was professor of classics in Acadia College (1860-5), and of history and rhetoric in Dalhousie College, Halifax, from 1865 until his death. Among his publications are: "*The Dodge Club*" (1866); "*Cord and Creese*" (1867); "*A Comedy of Terrors*" (1872); "*The Living Link*" (1874); and many books for boys, including "*Treasures of the Sea*." A posthumous work, "*A Strange Manuscript Found in a Copper Cylinder*," appeared in 1888. A treatise of his on rhetoric was published in 1878.

**Deming, Clarence**, American journalist: b. Litchfield, Conn., 1 Oct. 1848. He was graduated at Yale College 1872; was assistant editor of the *Troy Whig*, 1872-3, and served as night editor of the New Haven *Palladium* 1874-5. He was on the staff of the New York *Evening Post* 1874-84, and was afterward for several years editor of the New Haven *News*. He is the author of "*By Ways of Nature and Life*."

**Deming, Philander**, American lawyer and author: b. Carlisle, N. Y., 6 Feb. 1839. He was graduated at the University of Vermont 1861, and at the Albany Law School. From 1878-9 he was president of the New York State Law Stenographers' Association. He began to write stories for the magazines in 1873, and his published books include "*Adirondack Stories*"; "*Tompkins and Other Folks*."

**Demise**, *de-mīz'* (literally, a "laying down"), a grant by lease; it is applied to an estate either in fee-simple, or for a term of life or years. The word demise in a lease implies an absolute covenant on the part of the lessor for the lessee's peaceable enjoyment during the term. As applied to the crown of England, demise signifies its transmission to the next heir on being laid down by the sovereign. "So tender

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is the law of supposing even a possibility of the sovereign's death, that his natural dissolution is called his demise, an expression which merely signifies a transfer of property" (Blackstone).

**Demisemiquaver**, in musical notation it is half a semiquaver (sixteenth note), or the thirty-second part of a semibreve (whole note). When written as a note or rest it has three little crooks or bars appended to the stem.

**Demiurge**, *dēm'i-èrj* (Greek, *demiourgos*, "a handicraftsman"), designation applied by Plato and other philosophers to the Divine Being, considered as the Architect or Creator of the universe. The Gnostics made a distinction between the Demiurge and the Supreme Being; with them the first is the Jehovah of the Jews, who, though deserving to be honored as the Creator, was only the instrument of the Most High. He was also called Archon and Son of Chaos, chief of the lowest order of spirits or sons of the Pleroma. He corresponds to the Logos or Word of St. John.

In some of the Peloponnesian states of ancient Greece the name Demiurge seems to have been given to a chief magistrate, probably corresponding to the Roman tribune. The origin of evil was sometimes attributed to the Demiurge.

**Democe'des**, Greek physician: b. Crotona about 550 B.C.; d. 504 B.C. He was for a time physician to Polycrates, tyrant of Samos; was taken prisoner by the Persians and rose to a position of considerable influence at the court of Darius I. through his medical skill. He persuaded the king to send him with others on a secret mission to Greece, but escaped from his companions and fled to Crotona.

**Democracy** (Gr. *δημοκρατία* = *dēmos*, the people, and *κράτος*, power), a form of government in which the people, either directly or through their representatives, are supreme; according to Lincoln's definition, a government of the people, by the people, for the people. A pure democracy was for many centuries the dream of political idealists, because it meant liberty with the full power of self-development to the individual. The Greeks were the first people who tried to realize the democratic ideal. Aristotle enumerates among the three possible forms of government the monarchy, the oligarchy, and the democracy. The monarchy however may be a despotism, like that of Russia; a monarchy, like that of Germany overruling by the power of the army the will of chancellor or prime minister and parliament, and claiming the divine right of kings; or a limited monarchy, like that of England, in the history of which the parliament has more than once proved itself paramount. The oligarchy, the supremacy of a small class, may be based on hereditary rank, or property qualifications. The democracy may be mixed and partial, as when it tolerates the existence of slaves in its territory, as Athens did; or it may degenerate into ochlocracy, mob government, as in the early days of the French republic, whose counsels were swayed alternately by the power of a sort of oligarchical minority, and the stormy and fluctuating passions of the mob. More important is the distinction in a democracy between direct and indirect representation. The Athenian democracy professed to establish direct representation of the demos. In the agora or place of legislative assembly everyone but slaves might

speak and vote. Such was the theory, but as a matter of fact only 1 in 40 was qualified to vote out of a population of more than half a million. Nor can it be forgotten that direct representation in the agora, or parliament of Athens, was practically limited to the city of Athens; not even the whole territory of Attica was represented there, much less the Athenian islands and dependencies. Even at Athens, the importance of the masses was never recognized. The main power was aristocratic, and the conflicts of the agora exhibited the people swayed hither and thither by speeches of men like Pericles and Alcibiades, or lashed into fury by plebeian Cleon in his vain attempt to break through the phalanx of aristocratic exclusiveness. The Roman republic was not a democracy in the sense of giving full voice to the will of the people; its republicanism consisted in a hatred for the name of king. The essence of a democracy lies in the abolition of institutions which shall give constitutional permanence to class distinctions. In the light of this principle it will plainly be seen that the mediæval communes or republics of Italy fell very far short of being democratic in their character. Here we may point out how much confusion there exists in men's minds in distinguishing between political and social democracy, between the democracy of laws and the democracy of sentiment and manners. The principle of the legal and political equality of men is not inconsistent with the utmost variety of natural and social distinctions. It only forbids the creation by law of artificial distinctions. The example of the American people shows that democratic political institutions are compatible with very great inequalities in cultivation, manners, style of living, social consideration and the distribution of property.

Modern democracy, as we now see it, is the result of a gradual process of development continued through centuries amidst the severest struggles. Such struggle will appear to be inevitable, when we consider that democracies have grown up in large states in which absolutism formerly prevailed, and in which the military system prevails even yet. Among the decisive steps in the modern struggle of the people against the old classes and systems should be noted the long contest of the Dutch against Spain, the great English revolutions of 1642 and 1688, the war of American Independence in 1776, the great French Revolution of 1789, and the revolutionary periods of 1830 and 1848. The English revolutions of 1642 and 1688 established parliamentary rule in England, though on a narrow basis. Yet they had the important result of proving the fitness of a new type of government, which further became a model for similar institutions in other countries. The greatest event in the evolution of democracy, however, was the French Revolution of 1789; though it failed for the time, it shook the old system to its foundations; it everywhere spread new ideas, and raised questions that could not again be set aside. The revolution of 1830 showed that the reactionary conditions prevalent after Waterloo had no claim to permanency. The revolutionary movements of 1848, which affected France, Italy, Austria and Germany, were apparently a failure, yet they overthrew what remained of the feudal system in western and central Europe. But the most significant thing connected with that period is the fact that

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only a few years afterward universal suffrage was introduced in all the countries where its influence had been felt. Governments which had been most active in suppressing the revolution found it expedient to adopt its cardinal principles. The fundamental basis of democracy is the recognition of the rights of man as man. Its central principle is the equality of all men before the law, without regard to birth, property, or social rank; from which principle is deduced the right of all men to an equal voice or vote in deciding upon public affairs, or in selecting agents and representatives to perform the functions of legislation and to execute the laws. The principles of democracy are forcibly and clearly stated in the American Declaration of Independence, in the words of Thomas Jefferson, who has been called "the apostle of democracy": "We hold these truths to be self-evident; that all men are created equal; that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness. That, to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed." These principles are still more fully developed in the constitutions of the States of the Union. The constitution of New Hampshire (1792) says: "All men are born equally free and independent; therefore all government of right originates from the people. All power residing originally in and being derived from the people, all the magistrates and officers of the government are their substitutes and agents, and at all times accountable to them." These principles are enunciated with equal clearness in the Constitutions of other States of the Union. It is as representing these principles that the government of the United States, as also of the several States that constitute the Union, is democratic in fullest sense of the term.

As we have seen, the distinctive features of the modern democracy are the widest personal freedom, by which each man has the liberty and responsibility of shaping his own career; equality before the law; and political power in the form of universal suffrage, exercised through the representative system. With these are associated universal education, and on the continent of Europe universal liability to military service. In Great Britain and the United States universal liability to military service exists also in theory as regards the militia. On the European continent it is a momentous fact imposed upon its peoples by the necessities of the struggle for existence, which the moral development of mankind has not yet been able so to regulate as to put an end to war. Anglo-Saxon countries are happily freer from such necessities. It is an interesting fact, however, that Prussia, which was the first great nation to adopt universal education, was also the first to introduce universal military service.

It is important to remember that the growth of the modern democracy has gone hand in hand with the general development of the most advanced nations of the world. The consolidation of the political power of the people is the result of far-reaching causes operating on a great scale throughout the history of modern nations. The growth of the democracy is intimately connected with the growth of every other factor in the social life. For example, the different stages in the rise of the democracy could be paralleled by the improvements in the art of printing. The

development of the democracy has on the one hand created the demand for cheap literature and cheap newspapers, but it has also on the other hand depended on the supply of them. Further, the growth of the cheap newspaper and of cheap literature depends on the industrial development, on the improvement of our technical capacities and resources, on man's growing mastery over nature. To the production of the daily newspaper a thousand technical appliances are subsidiary. Steam and electricity are the great forces that move the vast mechanism on which society is now based. In fact the growth of the democracy is intimately connected with an industrial and technical development which has culminated in the railway, the penny post, the electric telegraph, and the steam printing-press. The peculiar influence of the human voice has not been superseded, yet it is chiefly through the telegraph and the printing-press that the modern democracy obtains the education which the ancient democracy received in their popular assemblies and in the daily intercourse of the market-place.

**Democratic Party, The**, one of the chief political organizations in the United States. To Thomas Jefferson belongs the honor of being the founder, and for a third of a century the undisputed leader, of the Democratic party. Scarcely had the present Constitution been adopted before there appeared a line more or less distinct dividing those who, like Jefferson (q.v.), believed the people fully capable of self-government and trusted them, and those who, like Hamilton (q.v.), thought that the masses needed to be under the control of a strong and centralized government. This fundamental difference of opinion manifested itself in the treatment of every important question, and party organizations were soon perfected.

As Jefferson himself has described the birth of parties in the United States, his opinion can be accepted as authoritative. In a letter written in June 1823, near the close of his life, to William Johnson, he said:

At the formation of our government, many had formed their political opinions on European writings and practices, believing the experience of old countries, and especially of England abusive as it was, to be a safer guide than mere theory. The doctrines of Europe were that men in numerous associations cannot be restrained within the limits of order and justice, but by forces physical and moral, wielded over them by authorities independent of their will. Hence their organization of kings, hereditary nobles, and priests. Still further to constrain the brute force of the people, they deem it necessary to keep them down by hard labor, poverty and ignorance, and to take from them as from bees, so much of their earnings, as that unremitting labor shall be necessary to obtain a sufficient surplus barely to sustain a scanty and miserable life. And these earnings they apply to maintain their privileged orders in splendor and idleness, to fascinate the eyes of the people, and excite in them an humble adoration and submission, as to an order of superior beings. Although few among us had gone all these lengths of opinion, yet many had advanced, some more, some less, on the way. And in the convention which formed our government, they endeavored to draw the cords of power as tight as they could obtain them, to lessen the dependence of the general functionaries on their constituents, to subject to them those of the States, and to weaken their means of maintaining the steady equilibrium which the majority of the convention had deemed salutary for both branches, general and local. To recover, therefore, in practice the powers which the nation had refused and to warp to their own wishes those actually given, was the steady object of the Federal party.

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Ours, on the contrary, was to maintain the will of the majority of the convention and of the people themselves. We believed, with them, that man was a rational animal endowed by nature with rights and with an innate sense of justice; and that he could be restrained from wrong and protected in right, by moderate powers confided to persons of his own choice, and held to their duties by dependence on his own will. We believe that the complicated organization of kings, nobles, and priests, was not the wisest nor best to effect the happiness of associated man; that wisdom and virtue were not hereditary; that the trappings of such a machinery, consumed by their expense, those earnings of industry they were meant to protect, and, by the inequalities they produced, exposed liberty to suzerainty. We believe that men, enjoying in ease and security the full fruits of their own industry, enlisted by all their interests on the side of law and order habituated to think of themselves and to follow their reason as their guide, would be more easily and safely governed, than with minds nourished in error and vitiated and debased, as in Europe, by ignorance indigence, and oppression. The cherishment of the people then was our principle, the fear and distrust of them that of the other party. Composed, as we were, of the landed and laboring interests of the country, we could not be less anxious for a government of law and order than were the inhabitants of the cities, the strongholds of federalism. And whether our efforts to save the principles and form of our Constitution have not been salutary, let the present republican freedom, order, and prosperity of our country determine.

Jefferson not only gave a history of the formation of parties, but fortunately for later generations, he enumerated the elements which each party contained. In a letter to C. E. Ebeling in 1795 he said:

Two parties exist within the United States. They embrace respectively the following descriptions of persons. The Anti-Republicans consist of: (1) The old refugees and Tories; (2) British merchants residing among us, and composing the main body of our merchants; (3) American merchants trading on British capital, another great portion; (4) speculators and holders in the banks and public funds; (5) officers of the Federal government with some exceptions; (6) office hunters willing to give up principles for places,—a numerous and noisy tribe; (7) nervous persons, whose languid fibres have more analogy with a passive than active state of things. The Republican party of our Union comprehends: (1) The entire body of landholders throughout the United States; (2) the body of laborers not being landholders whether in husbanding or the arts. The latter is to the aggregate of the former party probably as 500 to 1; but their wealth is not as disproportionate, though it is also greatly superior and is in truth the foundation of that of their antagonists. Trifling as are the numbers of the Anti-Republican party, there are circumstances which give them an appearance of strength and numbers. They all live in cities together, and can act in a body and readily at all times; they give chief employment to the newspapers, and, therefore, have most of them under their command. The agricultural interest is dispersed over a great extent of country, have little means of intercommunication with each other, and feeling their own strength and will, are conscious that a single exertion of these will at any time crush the machinations against their government.

Jefferson's philosophical mind sought not only the facts, but the reason for the facts, and in 1824, in a letter to H. Lee he thus classified men according to their party tendencies:

Men by their constitutions are naturally divided into two parties: (1) Those who fear and distrust the people and wish to draw all powers from them into the hands of the higher classes; (2) those who identify themselves with the people, have confidence in them, cherish and consider them as the most wise depository of the public interests. In every country these two parties exist, and in every one where they are free to think, speak, and write, they will declare themselves. Call them, therefore, liberals and serviles, Jacobins and ultras, Whigs and Tories, Republicans and

Federalists, aristocrats and Democrats, or by whatever name you please, they are the same parties still, and pursue the same object. The last appellation of aristocrats and Democrats is the true one expressing the essence of all.

Jefferson's purpose was to found a party that would be really democratic in personnel, in purpose and in method. The party, however, was at first called the Republican party, and afterward the Democratic-Republican party. It was not until in Jackson's time that it became universally known by its present name. As there were no national conventions and no national platforms in the early days of the Republic the position of the party on public questions must be gathered from the words and speeches of the leaders and from the votes of the members of the party in Congress. Jefferson's first inaugural address contained the essence of the party creed as generally accepted during the first quarter of the 19th century. In fact, it is still the creed of the party, and no group of men desiring to maintain an influence in the party can even now admit any essential departure from it. It will be found below:

About to enter, fellow-citizens, on the exercise of duties which comprehend everything dear and valuable to you, it is proper you should understand what I deem the essential principles of our government, and consequently those which ought to shape its administration. I will compress them within the narrowest compass they will bear, stating the general principle, but not all its limitations. Equal and exact justice to all men, of whatever State or persuasion, religious or political; peace, commerce, and honest friendship with all nations, entangling alliances with none; the support of the State governments in all their rights, as the most competent administrations for our domestic concerns and the surest bulwarks against Anti-Republican tendencies; the preservation of the general government in its whole constitutional vigor, as the sheet anchor of our peace at home and safety abroad; a jealous care of the right of election by the people—a mild and safe corrective of abuses which are lopped by the sword of revolution where peaceable remedies are unprovided; absolute acquiescence in the decisions of the majority and vital principle of republics, from which is no appeal but to force, the vital principle and immediate parent of despotism; a well-disciplined militia, our best reliance in peace and for the first moments of war, till regulars may relieve them; the supremacy of the civil over the military authority; economy in the public expense that labor may be lightly burdened; the honest payment of our debts and sacred preservation of the public faith; encouragement of agriculture, and of commerce as its handmaid; the diffusion of information and arraignment of all abuses at the bar of the public reason; freedom of religion, freedom of the press, and freedom of person under the protection of the *habeas corpus*, and trial by juries impartially selected. These principles form the bright constellation which has gone before us and guided our steps through an age of revolution and reformation. The wisdom of our sages and blood of our heroes have been devoted to their attainment. They should be the creed of our political faith, the text of civic instruction, the touchstone by which to try the services of those we trust; and should we wander from them in moments of error or of alarm, let us hasten to retrace our steps and to regain the road which alone leads to peace, liberty, and safety.

The first and most fundamental difference between the Democratic party (when it was known as the Republican party, afterward as the Democratic-Republican party, and to-day as the Democratic party) and the party which has opposed it (first known as the Federal party, then as the Whig party and more recently as the Republican party), was upon the construction of the Constitution. The former party has insisted upon a strict construction, while the latter

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has leaned toward a liberal construction of the Federal constitution. This difference is a natural one for the Democratic party, believing in the right of the people to, and in the capacity of the people for, self-government, has insisted upon giving them as large a part as possible in the control of their own affairs.

It follows, therefore, that the Democratic party favors local self-government and opposes the centralization of power in remote centres. It believes that the nearer the people are to their government the more effective will be their control over it. The various parties that have opposed the Democratic party have given more or less emphasis to the Hamiltonian view and have increased the power of the representative at the expense of the constituents.

While this distinction has not at all times been clearly marked, and while these views have not been held by all the individual members, the general tendency has existed.

In the very beginning this tendency was illustrated in the Alien and Sedition laws, enacted by the Federalists and in the Kentucky and Virginia resolutions supported by the Democrats. (See ALIEN AND SEDITION ACTS, also Kentucky resolutions and Virginia resolutions.) Both parties in this instance went to the extreme, the Federalists attempting to confer dangerous power upon the Federal government, the Democrats asserting views which were afterward so misconstrued as to weaken the Federal Union. The preservation of the balance between the Federal government and the State governments has always been a delicate matter, and as the line cannot be drawn with mathematical accuracy there has always been room for dispute; the public sentiment having gone to the one side or the other as it was necessary to maintain the equilibrium. It is likely that this discussion will continue, but the efforts to carry the government to an extreme in either direction will be thwarted by the conservative middle class, which rallies to the support of the side that is attacked.

Beginning with Jefferson's administration in 1801, and continuing to the end of Monroe's administration in 1825, the Democratic party held undisputed sway in the nation. Jefferson, like Washington, refused to consider a third term, and his secretary of state, James Madison (q.v.), succeeded him. Madison, following the example set by his predecessor, retired at the end of his second term, and James Monroe (q.v.), who had been his secretary of state, succeeded him.

The War of 1812 was conducted by the Madison administration, and it was during this period that the Hartford resolutions were adopted by a convention of Federalists which met at Hartford, Conn., in December 1814. These resolutions went further in the direction of States rights than either the Kentucky resolutions or the Virginia resolutions. They began by recommending "to the legislatures of the several States represented in this convention, to adopt all such measures as may be necessary effectually to protect the citizens of said States from the operation and effects of all acts which have been or may be passed by the Congress of the United States, which shall contain provisions subjecting the militia or other citizens to forcible drafts, conscriptions, or impressments

not authorized by the Constitution of the United States."

While the Hartford resolutions announced a political policy, they had their origin in the commercial interests which were affected by the War of 1812, and by the embargo act (see EMBARGO) which was enacted as a war measure.

The Federal party which supported Clinton's candidacy in 1812 laid great stress upon the commercial interests. The platform adopted by the New York Federalists urged the election of Clinton as the surest method of guaranteeing the protection of those commercial interests which were flagging "under the weakness and imbecility of the administration." The Federalists attacked what they called the Virginia regency, and the Hartford resolutions recommended a constitutional amendment making the President ineligible for renomination, and another prohibiting the selection of two Presidents in succession from the same State.

It was during the administration of James Monroe that the doctrine, afterward known by his name, and followed ever since, was promulgated. The doctrine was set forth in a message sent to Congress by James Monroe on 2 Dec. 1823. (See MONROE DOCTRINE.) The following is the text covering this subject:

In the wars of European powers, in matters relating to themselves, we have never taken any part, nor does it comport with our policy so to do. It is only when our rights are invaded or seriously menaced that we resent injuries or make preparations for our defense. With the movements on this hemisphere we are, of necessity, more immediately connected, and by causes which must be obvious to all enlightened and impartial observers. The political system of the allied powers (the Holy Alliance) is essentially different in this respect from that of America. This difference proceeds from that which exists in their respective governments. And to the defense of our own, which has been achieved by the loss of so much blood and treasure, and matured by the wisdom of their most enlightened citizens and under which we have enjoyed unexampled felicity, this whole nation is devoted. We owe it, therefore, to candor and to the amicable relations existing between the United States and those powers to declare that we should consider any attempt on their part to extend their system to any portion of this hemisphere as dangerous to our peace and safety. With the existing colonies or dependencies of any European power we have not interfered, and shall not interfere. But with the governments who have declared their independence and maintained it we have on great consideration and on just principles, acknowledged we could not view any interposition for the purpose of oppressing them, or controlling in any other manner their destiny, by any European power, in any other light than as the manifestation of an unfriendly disposition toward the United States. Our policy in regard to Europe, which was adopted at an early stage of the wars which have so long agitated that quarter of the globe, nevertheless remains the same, which is not to interfere in the internal concerns of any of its powers; to consider the government *de facto* as the legitimate government for us; to cultivate friendly relations with it, and to preserve those relations by a frank, firm, and manly policy; meeting in all instances the just claims of every power, submitting to injuries from none. But in regard to these continents, circumstances are eminently and conspicuously different. It is impossible that the allied powers should extend their political system to any portion of either continent without endangering our peace and happiness; nor can any one believe that our southern brethren, if left to themselves, would adopt it of their own accord. It is equally impossible, therefore, that we should behold such interposition, in any form, with indifference.

This message was written after consultation with Jefferson, who was then living in retire-



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ment at Monticello. The following extract from a letter written by Jefferson to Monroe in October 1823, not only shows Jefferson's part in the formulation of the doctrine, but also proves his foresight and his comprehension of American interests, and his devotion to the welfare of his country:

The question presented by the letters you have sent me, is the most momentous which has been offered to my contemplation since that of Independence. That made us a nation, this sets our compass and points the course which we are to steer through the ocean of time opening on us. And never could we embark on it under circumstances more auspicious. Our first and fundamental maxim should be, never to entangle ourselves in the broils of Europe. Our second, never to suffer Europe to intermeddle with cis-Atlantic affairs. America, North and South, has a set of interests distinct from those of Europe and peculiarly her own. She should, therefore, have a system of her own, separate and apart from that of Europe. While the last is laboring to become the domicile of despotism, our endeavor should surely be to make our hemisphere that of freedom. One nation most of all, could disturb us in this pursuit; she now offers to lead, aid, and accompany us in it. By acceding to her proposition, we detach her from the bands, bring her mighty weight into the scale of free government, and emancipate a continent at one stroke, which might otherwise linger long in doubt and difficulty. Great Britain is the nation which can do us the most harm of any one, or all on earth; and with her on our side we need not fear the whole world. With her, then, we should most sedulously cherish a cordial friendship; and nothing would tend more to knit our affections than to be fighting once more side by side in the same cause. Not that I would purchase even her amity at the price of taking part in her wars. But the war in which the present proposition might engage us, should that be its consequence, is not her war, but ours. Its object is to introduce and establish the American system, of keeping out of our land all foreign powers, of never permitting those of Europe to intermeddle with the affairs of our nations. It is to maintain our own principle, not to depart from it. And if to facilitate this, we can effect a division in the body of the European powers, and draw over to our side its most powerful member, surely we should do it. But I am clearly of Mr. Canning's opinion, that it will prevent instead of provoke war. With Great Britain withdrawn from their scale and shifted into that of our two continents, all Europe combined would not undertake such a war. For how would they propose to get at either enemy without superior fleets? Nor is the occasion to be slighted which this proposition offers, of declaring our protest against the atrocious violations of the rights of nations by the interference of any one in the internal affairs of another, so flagitiously begun by Bonaparte, and now continued by the equally lawless Alliance calling itself Holy. But we have first to ask ourselves a question. Do we wish to acquire to our own confederacy any one or more of the Spanish provinces? I candidly confess that I have ever looked on Cuba as the most interesting addition which could ever be made to our system of States. The control which, with Florida Point, this island would give us over the Gulf of Mexico, and the countries and isthmus bordering on it, as well as all those whose waters flow into it, would fill up the measure of our political well-being. Yet, as I am sensible that this can never be obtained, even with her own consent, but by war; and its independence, which is our second interest (and especially its independence of England), can be secured without it, I have no hesitation in abandoning my first wish to future chances and accepting its independence, with peace and the friendship of England, rather than its association, at the expense of war and her enmity. I could honestly, therefore, join in the declaration proposed, that we aim not at the acquisition of any of those possessions, that we will not stand in the way of any amicable arrangement between them and the mother country; but that we will oppose, with all our means, the forcible interposition of any other power, as auxiliary, stipendiary, or under any other form or pretext, and most especially, their transfer to any power by conquest, cession, or acquisition in any other way.

Jefferson died on 4 July 1824, just 50 years after the signing of the Declaration of Inde-

pendence. The year that marked his demise marked the entrance of the second great Democratic leader into the arena of politics.

Andrew Jackson (q.v.) of Tennessee, the hero of the War of 1812, had grown in fame and popularity from the day of his victory over the English at New Orleans. In 1824 he became the nominee of his party, and in the election following received 155,872 votes, as against 105,321 cast for John Quincy Adams; 44,282 cast for Crawford; and 46,587 cast for Henry Clay. In the Electoral College, Jackson received 99 votes, Adams 84, Crawford 41, and Clay 37. As no one of the candidates had a majority of the Electoral College the election of the President devolved upon the House of Representatives; and by a coalition between the friends of Adams and the friends of Clay, the former received the votes of 13 States, while Jackson received but 7 and Crawford 4.

The defeat of Jackson after he had secured a large plurality of the popular vote, and a considerable plurality in the Electoral College, aroused great partisan feeling, and from that time until 1828, Jackson was the candidate of the party, his campaign growing in strength as the years proceeded until when election day arrived he had a popular majority of nearly 140,000, and a majority of nearly 100 in the Electoral College. Calhoun was chosen Vice-President at the same time.

The chief features of Jackson's administration were his treatment of the nullification act of the South Carolina legislature, and his veto of the act for the rechartering of the United States bank. He took vigorous steps to enforce the Federal authority and, in an elaborate message, presented the arguments against the right of secession with a force and clearness never since surpassed. His action in this matter resulted in the alienation of John C. Calhoun, who up to that time had been a staunch political friend.

The fight over the bank charter not only occupied a large part of the time of his administration, but resulted in a controversy that permeated other issues. The Senate passed a resolution censuring him for removing the deposits from the bank, and this became an issue. Under the leadership of Thomas H. Benton, of Missouri, the Democrats began a fight for the reversal of the action of the Senate, and finally secured a majority of that body and expunged the resolution.

While Jackson's military achievements were the foundation for his early popularity, his great political fame was due to championing the cause of the masses, as against the concentrated power of wealth. In his message vetoing the bank charter he presented with emphasis and accuracy the Democratic view of the sphere of government. He said:

Distinctions in society will always exist under every just government. Equality of talents, of education, or of wealth, cannot be produced by human institutions. In the full enjoyment of the gifts of heaven and the fruits of superior industry, economy, and virtue every man is equally entitled to protection by law. But when the laws undertake to add to those natural and just advantages artificial distinctions—to grant titles, gratuities, and exclusive privileges—to make the rich richer and the potent more powerful—the humble members of society—the farmers, mechanics, and the laborers—who have neither the time nor the means of securing like favors for themselves,



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have a right to complain of the injustice of their government.

Jackson's position on the bank charter represented the views of his party adherents. His veto was sent to Congress on 10 July 1831, and it was the main issue of the campaign of 1832, when with Henry Clay as his opponent he secured a popular plurality of 157,000. In the Electoral College he had 219 votes as against 49 cast for Clay. His secretary of state, Martin Van Buren, succeeded him as the Democratic candidate, and was elected, having both a popular majority and a majority in the Electoral College. Van Buren defeated William Henry Harrison in that year, and was defeated by him in the following campaign. In the earlier campaigns the nominations were made by a Congressional caucus, or by the various States, but Jackson's renomination in 1832 was made by a national convention held at Baltimore, and Van Buren was nominated by a convention held at the same place four years later.

In 1840 the Democratic convention was again held at Baltimore, Van Buren was renominated and a lengthy platform was adopted. As this platform was the basis of all platforms adopted from that time to the breaking out of the Civil War it is worthy of reproduction. It was as follows:

1. Resolved, That the Federal government is one of limited powers, derived solely from the Constitution, and the grants of powers shown therein ought to be strictly construed by all the departments and agents of the government, and that it is inexpedient and dangerous to exercise doubtful constitutional powers.

2. Resolved, That the Constitution does not confer upon the general government the power to commence and carry on a general system of internal improvements.

3. Resolved, That the Constitution does not confer authority upon the Federal government directly or indirectly, to assume the debts of the several States, contracted for local internal improvements or other State purposes; nor would such assumption be just or expedient.

4. Resolved, That justice and sound policy forbid the Federal government to foster one branch of industry to the detriment of another, or to cherish the interests of one portion to the injury of another portion of our common country—that every citizen and every section of the country has a right to demand and insist upon an equality of rights and privileges, and to complete an ample protection of persons and property from domestic violence or foreign aggression.

5. Resolved, That it is the duty of every branch of the government to enforce and practice the most rigid economy in conducting our public affairs, and that no more revenue ought to be raised than is required to defray the necessary expenses of the government.

6. Resolved, That Congress has no power to charter a United States bank; that we believe such an institution one of deadly hostility to the best interests of the country, dangerous to our Republican institutions, and the liberties of the people, and calculated to place the business of the country within the control of a concentrated money power and above the laws and the will of the people.

7. Resolved, That Congress has no power under the Constitution to interfere with or control the domestic institutions of the several States; and that such States are the sole and proper judges of everything pertaining to their own affairs, not prohibited by the Constitution; that all efforts by Abolitionists or others, made to induce Congress to interfere with questions of slavery or to take incipient steps in relation thereto, are calculated to lead to the most alarming and dangerous consequences, and that all such efforts have an inevitable tendency to diminish the happiness of the people, and endanger the stability and permanence of the Union, and ought not to be countenanced by any friend to our political institutions.

8. Resolved, That the separation of the moneys of the government from banking institutions is indispensable for the safety of the funds of the government and the rights of the people.

9. Resolved, That the liberal principles embodied by Jefferson in the Declaration of Independence, and sanctioned in the Constitution, which make ours the land of liberty and the asylum of the oppressed of every nation, have ever been cardinal principles in the Democratic faith; and every attempt to abridge the present privilege of becoming citizens, and the owners of soil among us ought to be resisted with the same spirit which swept the Alien and Sedition laws from our statute book.

As the names of several different persons had been presented for Vice-President the convention of 1840 made no nominations for that office, but advocated resolutions leaving the decision to members of the party in the various States, and trusting that "before the election took place the opinion would be so concentrated as to enable the Electoral College to secure the choice of a Vice-President."

Upon the death of Harrison, John Tyler became President, and during his term vetoed two bills, which had for their object the re-establishing of the United States bank. Tyler favored the annexation of Texas, which had separated from Mexico and had existed under an independent government since 1836. Jas. K. Polk, the Democratic candidate, also favored annexation, while Henry Clay, for a third time a candidate for the Presidency, opposed annexation.

In the platform of 1844, the first nine resolutions of the platform of 1840 were reaffirmed, and new resolutions added demanding, first, that the proceeds of public lands be sacredly applied to the national object specified in the Constitution, rather than distributed among the States; second, sustaining and defending the veto of the President which had "thrice saved the Americans from the corrupt and tyrannical domination of the banks of the United States, and third, declaring for the annexation of Texas. The campaign resulted in the election of Polk and Dallas, although the majority in the Electoral College was proportionately larger than the popular majority.

The campaign of 1848 was waged with Lewis Cass of Michigan and William O. Butler of Kentucky as the Democratic candidates for President and Vice-President. The platform of 1848 reaffirmed that of 1840 and 1844, and added new planks covering new questions. Resolution No. 19 of the platform of 1848 is given below because it reiterates the Democratic contention in regard to the value of self-government. It reads:

Resolved, That in view of the recent development of this grand political truth, of the sovereignty of the people and their capacity and power for self-government, which is prostrating thrones and erecting republics on the ruins of despotism in the Old World, we feel that a high and sacred duty is devolved, with increased responsibility, upon the Democratic party of this country, as the party of the people, to sustain and advance among us constitutional liberty, equality, and fraternity, by continuing to resist all monopolies and exclusive legislation for the benefit of the few at the expense of the many, and by a vigilant and constant adherence to those principles and compromises of the Constitution, which are broad enough and strong enough to embrace and uphold the Union as it was, the Union as it is, and the Union as it shall be, in the full expansion of the energies and capacity of this great and progressive people.

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The Whig candidates, however, Zachary Taylor and Millard Fillmore, were successful that year, having both a popular majority and a majority in the Electoral College. In the campaign of 1852, Franklin Pierce of New Hampshire and William R. King of Alabama were the Democratic nominees, and the platform reiterated the leading planks of 1840, 1844 and 1848.

The platform of 1852 also reiterated the principles laid down in the Kentucky and Virginia resolutions, and defended the Mexican war "as just and necessary." The campaign of 1852 resulted in an overwhelming Democratic victory, the popular plurality being more than 200,000.

The slavery question was constantly growing in prominence, and at last exerted an influence upon every issue that arose. The position taken by the various parties in regard to the Mexican war was largely determined by the slavery views held by the members of the parties.

The Fugitive Slave laws of the various States also came up for consideration, and each election showed an increase in the anti-slavery sentiment. In 1856 the Democratic platform again reaffirmed the principles set forth in 1840, and reiterated in subsequent campaigns. It quoted resolution 7 of the platform of 1840, and said:

That the foregoing proposition covers, and was intended to embrace, the whole subject of slavery agitation in Congress; and, therefore, the Democratic party of the Union, standing on this national platform, will abide by, and adhere to, a faithful execution of the acts known as the compromise measures settled by the Congress of 1850; That "the act for reclaiming fugitives from service labor" included; which act, being designed to carry out an express provision of the Constitution, cannot, with fidelity thereto, be repealed, or so changed as to destroy or impair its efficiency; that the Democratic party will resist all attempts at renewing in Congress, or out of it, the agitation of the slavery question, under whatever shape or color the attempt may be made.

The Republican party took the name by which the Democratic party was originally known, and it held its first national convention in 1856, John C. Fremont and William L. Dayton being the nominees. James Buchanan and John C. Breckinridge were the Democratic nominees. They received a majority of 60 in the Electoral College and a popular plurality of about 500,000. The American party, led by Millard Fillmore and Andrew J. Donelson, secured only 8 electors but polled 874,000 votes. During the Buchanan administration the Dred Scott decision was rendered, and this, while it was a legal victory for the friends of slavery, resulted in an anti-slavery agitation that inured to the advantage of the Republican party.

In 1860 the conflict between the northern and southern Democrats became irreconcilable, and the Charlestown convention, which met 23 April, having failed to harmonize the differences, adjourned without a nomination. The northern Democrats met at Baltimore 18 June and nominated Stephen A. Douglas of Illinois for President and Herschel V. Johnson of Georgia for Vice President, while the southern wing of the party met at the same place 10 days later, and nominated John C. Breckinridge of Kentucky for President and Joseph Lane of Oregon for Vice-President. As the Douglas platforms adopted at that time represented the positions taken by the two wings of the party they will be found below:

1. Resolved, That we, the Democracy of the Union in convention assembled, hereby declare our affiance of the resolutions unanimously adopted and declared as a platform of principles by the Democratic convention at Cincinnati, in the year 1856, believing that Democratic principles are unchangeable in their nature when applied to the same subject matters; and we recommend, as the only further resolutions, the following:

Inasmuch as differences of opinion exist in the Democratic party as to the nature and extent of the powers of a Territorial legislature, and as to the powers and duties of Congress, under the Constitution of the United States, over the institution of slavery within the Territories.

2. Resolved, That the Democratic party will abide by the decisions of the Supreme Court of the United States on the question of constitutional law.

3. Resolved, That it is the duty of the United States to afford ample and complete protection to all its citizens, whether at home or abroad, and whether native or foreign.

4. Resolved, That one of the necessities of the age, in a military, commercial, and postal point of view, is speedy communication between the Atlantic and Pacific States; and the Democratic party pledge such constitutional government aid as will insure the construction of a railroad to the Pacific coast at the earliest practicable period.

5. Resolved, That the Democratic party are in favor of the acquisition of the island of Cuba, on such terms as shall be honorable to ourselves and just to Spain.

6. Resolved, That the enactments of State legislatures to defeat the faithful execution of the Fugitive Slave Law are hostile in character, subversive of the Constitution, and revolutionary in their effect.

7. Resolved, That it is in accordance with the true interpretation of the Cincinnati platform, that, during the existence of the Territorial governments, the measure of restriction, whatever it may be, imposed by the Federal Constitution on the power of the Territorial legislature over the subject of domestic relations, as the same has been or shall hereafter be finally determined by the Supreme Court of the United States, shall be respected by all good citizens, and enforced with promptness and fidelity by every branch of the general government.

The "Breckinridge platform" was as follows:

Resolved, That the platform adopted by the Democratic party at Cincinnati be affirmed, with the following explanatory resolutions:

1. That the government of a Territory, organized by an act of Congress is provisional and temporary; and, during its existence, all citizens of the United States have an equal right to settle, with their property in the Territory, without their rights, either of person or property, being destroyed or impaired by congressional or territorial legislation.

2. That it is the duty of the Federal government, in all its departments, to protect when necessary, the rights of persons and property in the Territories, and wherever else its constitutional authority extends.

3. That when the settlers in a Territory having an adequate population, form a State Constitution in pursuance of law, the right of sovereignty commences, and, being consummated by admission into the Union, they stand on an equal footing with the people of the other States, and the State thus organized ought to be admitted into the Federal Union, whether its Constitution prohibits or recognizes the institution of slavery.

4. That the Democratic party are in favor of the acquisition of the island of Cuba, on such terms as shall be honorable to ourselves, and just to Spain, at the earliest practicable moment.

5. That the enactments of State legislatures to defeat the faithful execution of the Fugitive Slave law are hostile in character, subversive of the Constitution and revolutionary in their effect.

6. That the Democracy of the United States recognize it as the imperative duty of this government to protect the naturalized citizens in all their rights, whether at home or in foreign lands, to the same extent as its native-born citizens.

Whereas, One of the greatest necessities of the age, in a political, commercial, postal, and military point of view, is a speedy communication between the Pacific and Atlantic coasts; therefore be it

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Resolved, That the Democratic party do hereby pledge themselves to use every means in their power to secure the passage of some bill to the extent of the constitutional authority of Congress, for the construction of a Pacific railroad, from the Mississippi River to the Pacific Ocean, at the earliest practicable moment.

It will be seen that both conventions reaffirmed the Cincinnati platform of 1856. It will also be noticed that the only difference between the platforms grew out of the slavery question, the Douglas platform leaving the question to the Supreme Court, promising to abide by its decision; the Breckinridge platform declaring that the people of a territory had the right to decide the slavery question for themselves, and also declaring that the citizens of the various States had the right to settle in a territory and carry their property with them (meaning slaves) without being interfered with by congressional action.

The election of 1860 resulted in a victory for the Republican party, whose candidates, Abraham Lincoln and Hannibal Hamlin, ran upon a platform denouncing "threats of disunion," and saying that "the new dogma, that the Constitution, of its own force, carries slavery into any or all of the Territories of the United States," was a "dangerous political heresy." The platform did not call for the abolition of slavery in the States where it existed, but asserted "that the normal condition of all the territory of the United States is that of freedom; that as our Republican fathers, when they had abolished slavery in all our national territory, ordained that 'no person shall be deprived of life, liberty or property, without due process of law,' it becomes our duty by legislation, whenever such legislation is necessary, to maintain this provision of the Constitution against all attempts to violate it; and we deny the authority of Congress, of a territorial legislature, or any individuals, to give legal existence to slavery in any Territory of the United States."

Lincoln received a popular plurality of nearly 500,000, and a plurality of 108 in the Electoral College. Douglas came second in the popular vote, but fell behind both the Breckinridge ticket and Bell and Everett ticket in the Electoral College. This was due to the fact that the Douglas vote was large in the States which Lincoln carried.

In the war between the States the supporters of Douglas enlisted side by side with the supporters of Lincoln, Douglas himself having urged the support of Lincoln in the war for the maintenance of the Union. During the War, however, many things were done which aroused criticism from the Democratic leaders, and by the Democrats generally. Among the things complained of were arrests and courts-martial in States not in insurrection, and where the civil authority was undisturbed.

The Democratic platform of 1864 announced "unswerving fidelity to the Union under the Constitution, as the only solid foundation of our strength, security and happiness as a people, and as a framework of government equally conducive to the welfare and prosperity of all the States, both Northern and Southern"; and then declared

as the sense of the American people, that after four years of failure to restore the Union by the experiment of war, during which, under the pretense of a military

necessity of a war power higher than the Constitution, the Constitution itself has been disregarded in every part and public liberty and private right alike trodden down, and the material prosperity of the country essentially impaired, justice, humanity, liberty, and the public welfare demand that immediate efforts be made for a cessation of hostilities, with a view to an ultimate convention of all the States, or other peaceable means, to the end that, at the earliest practicable moment, peace may be restored on the basis of the Federal union of all the States.

Gen. George B. McClellan of New Jersey was nominated by the Democratic party for President and George H. Pendleton of Ohio for Vice-President. The election resulted in a popular majority of 408,000 for the Republican ticket, and in an electoral majority of 191—Kentucky, New Jersey and Delaware being the only three of the 24 States giving their electoral vote to the Democratic ticket. It will be seen that the Republican plurality was less than it was in 1860.

The assassination of Abraham Lincoln and the inauguration of Vice-President Andrew Johnson (q.v.) as President precipitated a struggle in which most of the Republican senators and members of Congress were arrayed against the President. The Democrats took the side of the President, and with the aid of a few Republicans prevented the adoption of the articles of impeachment presented by the House.

During the reconstruction period that followed, the Democrats insisted that the States which were held in the Union should be given the rights and privileges of other States.

The campaign of 1868 was fought under the leadership of Horatio Seymour of New York and Francis P. Blair of Missouri, and the platform demanded:

1. Immediate restoration of all the States to their rights in the Union under the Constitution, and of civil government to the American people.
2. Amnesty for all past political offenses, and the regulation of the elective franchise in the States by their citizens.
3. Payment of all the public debt of the United States as rapidly as practicable—all money drawn from the people by taxation, except so much as is requisite for the necessities of the government, economically administered, being honestly applied to such payment; and when the obligations of the government do not expressly state upon their face, or the law under which they were issued does not provide that they shall be paid in coin, they ought, in right and justice, to be paid in the lawful money of the United States.
4. Equal taxation of every species of property according to its real value, including government bonds and other public securities.
5. One currency for the government and the people, the laborer and the office-holder, the pensioner, and the soldier, the producer and the bondholder.
6. Economy in the administration of the government; the reduction of the standing army and navy; the abolition of the Freedman's Bureau and all political instrumentalities designed to secure negro supremacy; simplification of the system and discontinuance of inquisitorial modes of assessing and collecting internal revenue; that the burden of taxation may be equalized and lessened, and the credit of the government and the currency made good; the repeal of all enactments for enrolling the State militia into national forces in times of peace; and a tariff for revenue upon foreign imports, and such equal taxation under the internal-revenue laws as will afford incidental protection to domestic manufactures, and as will, without impairing the revenue, impose the least burden upon, and best promote and encourage the great industrial interests of the country.
7. Reform of abuses in the administration; the expulsion of corrupt men from office; the abrogation of useless offices; and the restoration of rightful author-

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ity to, and the independence of, the executive and judicial departments of the government; the subordination of the military to the civil power, to the end that the usurpations of Congress and the despotism of the sword may cease.

8. Equal rights and protection for naturalized and native-born citizens, at home and abroad; the assertion of American nationality which shall command the respect of foreign powers, and furnish an example and encouragement to people struggling for national integrity, constitutional liberty, and individual rights; and the maintenance of the rights of naturalized citizens against the absolute doctrine of immutable allegiance and the claims of foreign powers to punish them for alleged crimes committed beyond their jurisdiction.

Besides this statement of the position of the parties, the platform arraigned the Republican party for its reconstruction policy, charging that instead of restoring the Union it had "so far as was in its power dissolved it and subjected 10 States in time of profound peace to military despotism and negro supremacy," and that it had "nullified the right of trial by jury, abolished the right of *habeas corpus* and overthrown the freedom of speech and press." The Republicans nominated Gen. Grant and Schuyler Colfax, and secured a popular plurality of about 300,000 (less than the plurality of 1864), and an electoral majority of 134.

In May 1872, a convention known as the Liberal Republican Convention was held at Cincinnati, Ohio, and nominated Horace Greeley of New York for President and Benjamin Gratz Brown of Missouri for Vice-President. The platform demanded the recognition of the doctrines of equality of all men before the law, and pledged the party's support to Articles 13, 14 and 15 of our amended national Constitution. It favored the sacred maintenance of the public credit, opposed repudiation and insisted upon the return to specie payments.

The Democrats met on 9 July at Baltimore and nominated the same ticket and adopted a platform substantially like the one adopted by the Liberal Republicans.

Those members of the Democratic party describing themselves as "straight-out" Democrats met 3 September following, and nominated Charles O'Connor of New York for President and John Quincy Adams of Massachusetts for Vice-President; although both declined, nearly 30,000 votes were cast for the head of the ticket. The platform declared that the Baltimore convention had betrayed the party into a false creed and false leadership, and proclaimed that the members of the "straight-out" Democratic party preferred principle to power, and would not surrender those principles in exchange for offices which Presidents confer." The election resulted in an overwhelming victory for the Republican ticket, Grant and Wilson receiving 286 electoral votes out of 317, and a popular plurality of more than 750,000.

The nomination of Horace Greeley brought to his party a large number of influential Republicans and alienated many Democrats, yet the party's vote was only about 125,000 more than the Democratic vote of 1868; while the Republican vote of 1872 was nearly 600,000 greater than the vote of four years before.

The Democrats entered the campaign of 1876 with courage and confidence. The discovery of corruption in several of the departments, and the conviction of officials high in authority, together with the panic of 1873, had broken the

prestige of the Republican party and caused a wide-spread demand for reform. The Democratic party took advantage of the situation, and nominated as its candidates Samuel J. Tilden of New York, who had become conspicuous in reform in his State, and Thomas A. Hendricks of Indiana, who represented all that was highest, purest and best in Democratic principle and purpose. The platform described the abuses of power and demanded reform in every department. Among other things it demanded reform in the tariff, and condemned the resumption clause of 1875.

The campaign resulted in a popular plurality of 250,000 for Tilden and Hendricks. The result, however, was disputed, and charges of fraud were made in the election of several States. The situation grew so serious that Congress created an Electoral Commission to which the whole matter was referred. This commission was composed of five senators selected by that body, five members of Congress selected by that body, and the five senior members of the Supreme Court. (See ELECTORAL COMMISSION.)

The Senate being Republican selected 3 Republicans and 2 Democrats; the House being Democratic selected 3 Democrats and 2 Republicans, and of the judges 3 were Republicans and 2 Democrats. The Electoral Commission thus contained 8 Republicans and 7 Democrats, and on every contested question the vote stood 8 to 7, each member throwing his vote so that it would aid his party.

The Democrats of 1880 endorsed the principles embodied in the platform of 1876, protested against centralization as dangerous to the government, and denounced the "great fraud of 1876 and 1877 by which upon a false count of the electoral votes of two States the candidate defeated at the polls was declared to be President, and for the first time in American history the will of the people was set aside under a threat of military violence." The righting of the wrong of 1876 was declared to be the paramount issue. Gen. Winfield Scott Hancock, the Democratic nominee, weakened his campaign by putting the tariff question aside as "a local issue." He was defeated, however, by a popular vote of less than 10,000, and only by 59 votes in the Electoral College.

In 1884 the Democrats met at Chicago and nominated Grover Cleveland of New York for President and Thomas A. Hendricks of Indiana for Vice-President. A platform of great length was adopted; the tariff question being the one discussed at most length. The platform contained the following plank on the money question: "We believe in honest money, the gold and silver coinage of the Constitution, and a circulating medium convertible into such money without loss." This platform also contained a plank reaffirming that portion of the Democratic platform of 1856, which endorsed the liberal principles of Jefferson.

The Republican ticket, headed by James G. Blaine and John A. Logan, received a plurality of a little more than 20,000 in the popular vote, but Mr. Cleveland had 37 majority in the Electoral College.

The Democratic platform of 1888 reaffirmed the platform adopted in 1884, and endorsed the President's views on the tariff question as ex-

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pressed in the tariff message which he sent to Congress in December 1887. The tariff question was made the paramount issue, and the campaign waged on this question, and resulted in the election of the Republican ticket, and its candidates, Benjamin Harrison and Levi P. Morton, that ticket having a majority of 65 in the Electoral College, although the Democratic ticket had a popular plurality of about 100,000.

During the Cleveland administration an attempt was made to reduce the tariff, and the Mills Bill received the support of the Democratic members of the Senate and House. The Republicans, however, took advantage of the Republican victory of 1888 to propose and enact a high tariff law, known as the McKinley Act, taking its name from the chairman of the Ways and Means Committee of the House. The passage of this law was followed by an increase in prices of commodities, and it became the paramount issue in the following campaign of 1892. The Democratic party that year nominated Grover Cleveland for a third time, and named Adlai E. Stevenson of Illinois as his running mate.

There was a fight in the convention over the tariff plank, and as finally adopted it declared that the Federal government had no constitutional power to impose and collect tariff duties except for revenue only. The trusts were denounced, and the party pledged to the enactment of laws made to prevent and control them.

The money plank of the platform was as follows:

We denounce the Republican legislation known as the Sherman Act of 1890 as a cowardly makeshift, fraught with possibilities of danger in the future which should make all of its supporters, as well as its author, anxious for its speedy repeal. We hold to the use of both gold and silver as the standard money of the country, and to the coinage of both gold and silver without discrimination against either metal or charge for mintage, but the dollar unit of coinage of both metals must be of equal intrinsic and exchangeable value or be adjusted through international agreement, or by such safeguards of legislation as shall ensure the maintenance of the parity of the two metals, and the equal power of every dollar at all times in the markets and in the payments of debts; and we demand that all paper currency shall be kept at par with and redeemable in such coin. We insist upon this policy as especially necessary for the protection of the farmers and laboring classes, the first and most defenseless victims of unstable money and a fluctuating currency.

President Harrison was renominated by the Republicans and Whitelaw Reid was placed upon the ticket with him. In the election the Democratic ticket polled a plurality of 132 in the Electoral College and popular plurality of about 380,000. The People's Party nominated James B. Weaver of Iowa for President and James G. Field of Virginia for Vice-President, and polled a little more than 1,000,000 votes.

During President Cleveland's second term, two questions occupied public attention, the money question and the tariff question. Congress was called together in extraordinary session in August 1893, and the President recommended the unconditional repeal of the Sherman law. By reference to the Democratic platform of 1892 it will be seen that the money plank contained a statement of the party's faith in the double standard, as well as its desire for the repeal of

the Sherman Act, and an effort to repeal the makeshift without restoring the double standard caused a division in the ranks of the party, but the President succeeded in securing the legislation which he desired; doing this, however, he had the support of a larger percentage of the Republican senators and members than he had of the Democrats.

Congressman Wilson, chairman of the Ways and Means Committee, reported a measure which bears his name, and the bill as it passed the House was satisfactory to the friends of tariff reform, but it was emasculated by the Senate, where a coterie of Democratic senators refused to support it until the rates of several schedules were raised. The President refused to sign the bill, but allowed it to become a law without his signature. The bill contained an income tax, but this clause was declared unconstitutional by the Supreme Court, the vote standing 5 to 4. The decision was rendered at the second hearing; at the first hearing the vote stood 4 to 4, and as the 9th judge who was not present until the second hearing favored the tax, it required a change of opinion on the part of one of the judges to render the income tax inoperative.

After the passage of the tariff law the currency question again occupied the attention of Congress and became the paramount issue in the campaign of 1896. The money issue was fought out in the party and the delegates to the Chicago convention were instructed to carry out the financial policy endorsed by the members of the State convention selecting them, who in turn had been instructed by county conventions. As a result of this inter-party contest, the advocates of bimetallism won a decisive victory, having more than two thirds of the national delegates.

The following platform was adopted:

We, the Democrats of the United States in National Convention assembled, do reaffirm our allegiance to those great essential principles of justice and liberty, upon which our institutions are founded, and which the Democratic party has advocated from Jefferson's time to our own—freedom of speech, freedom of press, freedom of conscience, the preservation of personal rights, the equality of all citizens before the law, and the faithful observance of constitutional limitations.

During all these years the Democratic party has resisted the tendency of selfish interests to the centralization of governmental power, and steadfastly maintained the integrity of the dual scheme of government established by the founders of this Republic of republics. Under its guidings and teachings the great principle of local self-government has found its best expression in the maintenance of the rights of the States and in its assertion of the necessity of confining the general government to the exercise of the powers granted by the Constitution of the United States.

The Constitution of the United States guarantees to every citizen the rights of civil and religious liberty. The Democratic party has always been the exponent of political liberty and religious freedom, and it renews its obligations and reaffirms its devotions to these fundamental principles of the Constitution.

Recognizing that the money question is paramount to all others at this time, we invite attention to the fact that the Federal Constitution named silver and gold together as the money metals of the United States, and that the first coinage law passed by Congress under the Constitution made the silver dollar the monetary unit and admitted gold to free coinage at a ratio based upon the silver-dollar unit.

We declare that the act of 1873 demonetizing silver without the knowledge or approval of the American people has resulted in the appreciation of gold and a corresponding fall in the prices of commodities produced by the people; a heavy increase in the burden of taxation and of all debts, public and private; the



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enrichment of the money-lending class at home and abroad; the prostration of industry and impoverishment of the people.

We are unalterably opposed to monometallism, which has locked fast the prosperity of an industrial people in the paralysis of hard times. Gold monometallism is a British policy, and its adoption has brought other nations into financial servitude to London. It is not only un-American, but anti-American, and it can be fastened on the United States only by the stifling of that spirit and love of liberty which proclaimed our political independence in 1776 and won it in the War of the Revolution.

We demand the free and unlimited coinage of both silver and gold at the present legal ratio of 16 to 1 without waiting for the aid or consent of any other nation. We demand that the standard silver dollar shall be a full legal tender, equally with gold, for all debts, public and private, and we favor such legislation as will prevent for the future the demonetization of any kind of legal-tender money by private contract.

We are opposed to the policy and practice of surrendering to the holders of the obligations of the United States the option reserved by law to the government of redeeming such obligations in either silver coin or gold coin.

We are opposed to the issuing of interest-bearing bonds of the United States in time of peace and condemn the trafficking with banking syndicates, which, in exchange for bonds and at an enormous profit to themselves, supply the Federal treasury with gold to maintain the policy of gold monometallism.

Congress alone has the power to coin and issue money, and President Jackson declared that this power could not be delegated to corporations or individuals. We, therefore, denounce the issuance of notes intended to circulate as money by national banks as in derogation of the Constitution, and we demand that all paper which is made a legal tender for public and private debts, or which is receivable for dues to the United States, shall be issued by the government of the United States and shall be redeemable in coin.

We hold that tariff duties shall be levied for purposes of revenue, such duties to be so adjusted as to operate equally throughout the country, and not discriminate between class or section, and that taxation should be limited by the needs of the government, honestly and economically administered. We denounce as disturbing to business the Republican threat to restore the McKinley law, which has twice been condemned by the people in national elections, and which, enacted under the false plea of protection to home industry, proved a prolific breeder of trusts and monopolies, enriched the few at the expense of the many, restricted trade and deprived the producers of the great American staples of access to their natural markets.

Until the money question is settled we are opposed to any agitation for further changes in our tariff laws, except such as is necessary to meet the deficit in revenue caused by the adverse decision of the Supreme Court on the income tax. But for this decision by the Supreme Court there would be no deficit in the revenue under the law passed by a Democratic Congress in strict pursuance of the uniform decisions of that court for nearly 100 years, that court having in that decision sustained constitutional objections to its enactment which had previously been overruled by the ablest judges who have ever sat on that bench. We declare that it is the duty of Congress to use all the constitutional power which remains after that decision, or which may come from its reversal by the court as it may hereafter be constituted, so that the burdens of taxation may be equally and impartially laid, to the end that wealth may bear its due proportion of the expense of the government.

We hold that the most efficient way of protecting American labor is to prevent the importation of foreign pauper labor to compete with it in the home market, and that the value of the home market to our American farmers and artisans is greatly reduced by a vicious monetary system which depresses the prices of their products below the cost of production, and thus deprives them of the means of purchasing the products of our home manufactures; and as labor creates the wealth of the country, we demand the passage of such laws as may be necessary to protect it in all its rights.

We are in favor of the arbitration of differences between employers engaged in interstate commerce and their employees, and recommend such legislation as is necessary to carry out this principle.

The absorption of wealth by the few, the consolidation of our leading railroad systems, and the formation of trusts and pools require a stricter control by the Federal government of those arteries of commerce. We demand the enlargement of the power of the Interstate Commerce Commission and such restriction and guarantees in the control of railroads as will protect the people from robbery and oppression.

We denounce the profligate waste of the money wrung from the people by oppressive taxation and the lavish appropriations of recent Republican congresses, which have kept taxes high, while the labor that pays them is unemployed and the products of the people's toil are depressed in price till they no longer repay the cost of production. We demand a return to that simplicity and economy which befits a Democratic government and a reduction in the number of useless offices the salaries of which drain the substance of the people.

We denounce arbitrary interference by Federal authorities in local affairs as a violation of the Constitution of the United States and a crime against free institutions, and we especially object to government by injunction as a new and highly dangerous form of oppression by which the Federal judges, in contempt of the laws of the States and rights of citizens, become at once legislators, judges, executioners; and we approve the bill passed at the last session of the United States Senate, and now pending in the House of Representatives, relative to contempts in Federal courts and providing for trials by jury in certain cases of contempt.

No discrimination should be indulged in by the government of the United States in favor of any of its debtors. We approve of the refusal of the Fifty-third Congress to pass the Pacific Railroad Funding Bill and denounce the effort of the present Republican Congress to enact a similar measure.

Recognizing the just claims of deserving Union soldiers, we heartily endorse the rule of the present commissioner of pensions, that no names shall be arbitrarily dropped from the pension roll; and the fact of enlistment and service should be deemed conclusive evidence against disease and disability before enlistment.

We favor the admission of the Territories of New Mexico, Arizona, and Oklahoma into the Union as States, and we favor the early admission of all the Territories having the necessary population and resources to entitle them to Statehood, and, while they remain Territories, we hold that the officials appointed to administer the government of any Territory, together with the District of Columbia and Alaska, should be *bona fide* residents of the Territory or District in which their duties are to be performed. The Democratic party believes in home rule and that all public lands of the United States should be appropriated to the establishment of free homes for American citizens.

We recommend that the Territory of Alaska be granted a delegate in Congress and that the general land and timber laws of the United States be extended to said Territory.

The Monroe Doctrine, as originally declared, and as interpreted by succeeding Presidents, is a permanent part of the foreign policy of the United States and must at all times be maintained.

We extend our sympathy to the people of Cuba in their heroic struggle for liberty and independence.

We are opposed to life tenure in the public service, except as provided in the Constitution. We favor appointments based on merit, fixed terms of office, and such an administration of the civil-service laws as will afford equal opportunities to all citizens of ascertained fitness.

We declare it to be the unwritten law of this Republic, established by custom and usage of one hundred years and sanctioned by the examples of the greatest and wisest of those who founded and have maintained our government, that no man should be eligible for a third term of the Presidential office.

The Federal government should care for and improve the Mississippi River and other great waterways of the Republic, so as to secure for the interior States easy and cheap transportation to tide water. When any waterway of the Republic is of sufficient importance to demand aid of the government, such aid should be extended upon a definite plan of continuous work until permanent improvement is secured.

Confiding in the justice of our cause and the necessity of its success at the polls, we submit the foregoing declaration of principles and purposes to the considerate judgment of the American people. We invite the support of all citizens who approve them and who desire to have them made effective through legislation,



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for the relief of the people and the restoration of the country's prosperity.

The minority, led by Senator Hill of New York, submitted the following, which was refused by the convention:

To the Democratic National Convention: 16 delegates, constituting the minority of the Committee on Resolutions, find many declarations in the report of the majority to which they cannot give their assent. Some of these are wholly unnecessary. Some are ill considered and ambiguously phrased, while others are extreme and revolutionary of the well-recognized principles of the party. The minority content themselves with this general expression of their dissent, without going into a specific statement of the objectionable features of the report of the majority; but upon the financial question, which engages at this time the chief share of public attention, the views of the majority differ so fundamentally from what the minority regard as vital Democratic doctrine as to demand a distinct statement of what they hold to as the only just and true expression of Democratic faith upon the paramount issue, as follows, which is offered as a substitute for the financial plank in the majority report:

"We declare our belief that the experiment on the part of the United States alone of free silver coinage and a change of the existing standard of value independently of the action of other great nations, would not only imperil our finances, but would retard or entirely prevent the establishment of international bimetalism, to which the efforts of the government should be steadily directed. It would place this country at once upon a silver basis, impair contracts, disturb business, diminish the purchasing power of the wages of labor, and inflict irreparable evils upon our nation's commerce and industry.

"Until international co-operation among leading nations for the coinage of silver can be secured we favor the rigid maintenance of the existing gold standard as essential to the preservation of our national credit, the redemption of our public pledges, and the keeping inviolate of our country's honor. We insist that all our paper and silver currency shall be kept absolutely at a parity with gold. The Democratic party is the party of hard money and is opposed to legal tender paper money as a part of our permanent financial system, and we therefore favor the gradual retirement and cancellation of all United States notes and Treasury notes, under such legislative provisions as will prevent undue contraction. We demand that the national credit shall be resolutely maintained at all times and under all circumstances."

The minority also feel that the report of the majority is defective in failing to make any recognition of the honesty, economy, courage and fidelity of the present Democratic administration. And they therefore offer the following declaration as an amendment to the majority report: "We commend the honesty, economy, courage and fidelity of the present Democratic National Administration."

The main resolutions submitted by the minority were rejected by more than a two thirds vote, and the platform as reported by the committee was adopted by the same vote. The resolution endorsing the President was defeated by a little less than two thirds.

The convention named as its candidates William Jennings Bryan of Nebraska, and Arthur Sewall of Maine. The "National" Democrats met at Indianapolis in September following, issued a platform endorsing the gold standard and named John M. Palmer and Simon B. Buckner as their national ticket. William McKinley of Ohio, and Garrett A. Hobart of New Jersey were the nominees of the Republican convention. The platform contained a plank favoring a protective tariff, and a plank opposing free coinage until foreign co-operation could be secured, but pledging the party to promote international bimetalism.

The People's party, generally known as the Populist party, met at St. Louis and adopted a platform containing the same silver plank as the

Democratic platform and endorsed and nominated the Democratic candidate for President. Instead of endorsing Mr. Sewall for the Vice-Presidency, the convention named Thomas E. Watson of Georgia for that office. The Silver Republicans met at the same time, endorsed the Democratic ticket and adopted a silver plank identical with the Democratic plank.

The campaign aroused deep feeling on both sides, and was warmly contested in the Central States. It became apparent early in the campaign that the Democratic ticket would carry the Western and Southern States, and that the Republican ticket would sweep the Eastern States. A very large vote was polled, the total that year being nearly 2,000,000 in excess of the total vote of four years before. The Republican party secured a popular plurality of 603,514. The electoral vote stood, McKinley and Hobart 271; Bryan and Sewall, 176.

Between 1896 and 1900 there was an improvement in industrial conditions; an increase in the volume of money, and a series of wars throughout the world. In 1898 the United States interfered in behalf of the Cubans and became involved in a war with Spain, which war resulted in Cuban independence, but during the war a naval victory in the Philippines put this nation in temporary control of those islands and resulted in our possession of them as an indemnity for the expenses incurred in behalf of the Cubans. The cession of the Philippine Islands to the United States raised a question which has not yet been settled. The sentiment is at present divided, the Democrats favoring the immediate promise that independence will be given as soon as a stable government is established, this independence to be accompanied by protection from outside interference. Some of the Republicans desire that the Philippine Islands be held under a colonial system, and others desire that the islands be given a territorial form of government with a view to ultimate statehood.

The Democratic convention which met at Kansas City 4 July 1900 endorsed the Declaration of Independence, and adopted the following platform:

"We, the representatives of the Democratic party of the United States, assembled in national convention on the anniversary of the adoption of the Declaration of Independence, do reaffirm our faith in that immortal proclamation of the inalienable rights of man and our allegiance to the Constitution framed in harmony therewith by the fathers of the Republic. We hold with the United States Supreme Court that the Declaration of Independence is the spirit of our government, of which the Constitution is the form and letter.

We declare again that all governments instituted among men derive their just powers from the consent of the governed; that any government not based upon the consent of the governed is tyranny, and that to impose upon any people a government of force is to substitute the methods of imperialism for those of a republic. We hold that the Constitution follows the flag, and denounce the doctrine that an Executive or Congress, deriving their existence and their powers from the Constitution, can exercise lawful authority beyond it or in violation of it.

We assert that no nation can long endure half republic and half empire, and we warn the American people that imperialism abroad will lead quickly and inevitably to despotism at home.

Believing in these fundamental principles, we denounce the Porto Rican law, enacted by a Republican Congress against the protest and opposition of the Democratic minority, as a bold and open violation of the nation's organic law and a flagrant breach of the national good faith. It imposes upon the people of

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Porto Rico a government without their consent and taxation without representation. It dishonors the American people by repudiating a solemn pledge made in their behalf by the commanding general of our army, which the Porto Ricans welcomed to a peaceful and unresisted occupation of their land. It doomed to poverty and distress a people whose helplessness appeals with peculiar force to our justice and magnanimity.

In this, the first act of its imperialistic programme, the Republican party seeks to commit the United States to a colonial policy inconsistent with republican institutions and condemned by the Supreme Court in numerous decisions.

We condemn and denounce the Philippine policy of the present administration. It has involved the public in unnecessary war, sacrificed the lives of many of our noblest sons and placed the United States, previously known and applauded throughout the world as the champion of freedom, in the false and un-American position of crushing with military force the efforts of our former allies to achieve liberty and self-government. The Filipinos cannot be citizens without endangering our civilization; they cannot be subjects without imperiling our form of government, and as we are not willing to surrender our civilization or to convert the republic into an empire, we favor an immediate declaration of the nation's purpose to give the Filipinos, first, a stable form of government; second, independence; and, third, protection from outside interference, such as has been given for nearly a century to the republics of Central and South America.

We are not opposed to territorial expansion when it takes in desirable territory which can be erected into States in the Union and whose people are willing and fit to become American citizens. We favor expansion by every peaceful and legitimate means. But we are unalterably opposed to seizing or purchasing distant islands to be governed outside the Constitution and whose people can never become citizens.

We are in favor of extending the Republic's influence among the nations, but believe that influence should be extended, not by force and violence, but through the persuasive power of a high and honorable example. The importance of other questions now pending before the American people is no wise diminished, and the Democratic party takes no backward step from its position on them, but the burning issue of imperialism growing out of the Spanish war involves the very existence of the republic and the destruction of our free institutions. We regard it as the paramount issue of the campaign.

The declaration in the Republican platform adopted at the Philadelphia convention, held in June 1900, that the Republican party "steadfastly adheres to the policy announced in the Monroe Doctrine," is manifestly deceptive. This profession is contradicted by the avowed policy of that party, in opposition to the spirit of the Monroe Doctrine, to acquire and hold sovereignty over large areas of territory and large numbers of people in the eastern hemisphere. We insist on the strict maintenance of the Monroe Doctrine in all its integrity, both in letter and in spirit, as necessary to prevent the extension of European authority on this continent and as essential to our supremacy in American affairs. At the same time we declare that no American people shall ever be held by force in unwilling subjection to European authority.

We oppose militarism. It means conquest abroad and intimidation and oppression at home. It means the strong arm which has ever been fatal to free institutions. It is what millions of our citizens have fled from in Europe. It will impose upon our peace-loving people a large standing army and unnecessary burden of taxation, and will be a constant menace to their liberties. A small standing army and a well disciplined State militia are amply sufficient in time of peace. This republic has no place for a vast military service and conscription.

In time of danger the volunteer soldier is his country's best defender. The National Guard of the United States should ever be cherished in the patriotic hearts of a free people. Such organizations are ever an element of strength and safety. For the first time in our history and coeval with the Philippine conquest has there been a wholesale departure from our time-honored and approved system of volunteer organization. We denounce it as un-American, un-Democratic and un-Republican and as a subversion of the ancient and fixed principles of a free people.

Private monopolies are indefensible and intolerable. They destroy competition, control the price of all

material and of the finished product, thus robbing both producer and consumer. They lessen the employment of labor, and arbitrarily fix the terms and conditions thereof, and deprive individual energy and small capital of their opportunity for betterment. They are the most efficient means yet devised for appropriating the fruits of industry to the benefit of the few at the expense of the many, and unless their insatiable greed is checked all wealth will be aggregated in a few hands and the republic destroyed.

The dishonest paltering with the trust evil by the Republican party in State and national platforms is conclusive proof of the truth of the charge that trusts are the legitimate product of Republican policies, that they are fostered by Republican laws, and that they are protected by the Republican administration for campaign subscriptions and political support.

We pledge the Democratic party to an unceasing warfare in nation, State and city against private monopoly in every form. Existing laws against trusts must be enforced, and more stringent ones must be enacted providing for publicity as to the affairs of corporations engaged in interstate commerce, requiring all corporations to show, before doing business outside the State of their origin, that they have no water in their stock, and that they have not attempted, and are not attempting, to monopolize any branch of business or the production of any articles of merchandise, and the whole constitutional power of Congress over interstate commerce, the mails and all modes of interstate communication shall be exercised by the enactment of comprehensive laws upon the subject of trusts.

Tariff laws should be amended by putting the products of trusts upon the free list, to prevent monopoly under the plea of protection.

The failure of the present Republican administration, with an absolute control over all the branches of the national government, to enact any legislation designed to prevent or even curtail the absorbing power of trusts and illegal combinations, or to enforce the anti-trust laws already on the statute books, proves the insincerity of the high-sounding phrases of the Republican platform.

Corporations should be protected in all their rights, and their legitimate interests should be respected, but any attempt by corporations to interfere with public affairs of the people or to control the sovereignty which creates them should be forbidden under such penalties as will make such attempts impossible.

We condemn the Dingley tariff law as a trust-breeding measure, skillfully devised to give the few favors which they do not deserve and to place upon the many burdens which they should not bear.

We favor such an enlargement of the scope of the interstate commerce law as will enable the commission to protect individuals and communities from discriminations and the public from unjust and unfair transportation rates.

It will be seen that the question of imperialism was made the paramount issue, the trust question coming next in the amount of attention given to it. The convention, however, reaffirmed the principles embodied in the Chicago platform, and reiterated the position taken four years before on the money question and on several other questions.

Mr. Bryan was renominated and Adlai E. Stevenson of Illinois was placed upon the ticket as the candidate for Vice-President. This ticket was endorsed later by the People's Party convention, and by the Silver Republican convention, both of which parties adopted platforms in line with the Democratic platform upon the leading issues. The Democratic ticket was also endorsed by the Anti-imperialists.

While the Democrats tried to focus public attention upon the menace of imperialism, the Republicans said: "Let well enough alone," and credited the improved conditions of the people in part to the gold standard and in part to the high-tariff law enacted in 1898. They protested against any change in the financial laws or the tariff law, and denied that they intended any

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departure from the principles of free government.

The Republican ticket, headed by President McKinley and Theodore Roosevelt of New York, was again successful, the popular plurality being 849,455. The electoral vote stood, McKinley and Roosevelt 292, Bryan and Stevenson 155. The campaign of 1900 did not excite as much interest as the preceding campaign, the total vote being practically the same in 1900 as it was in 1896.

In the foregoing narrative an attempt has been made to present a history of the Democratic party from its organization to the present time, and the party's position on public issues has been shown by quotations from the platforms adopted by its national conventions. While platforms are not so specific as laws, and not so elaborate as speeches, they are probably a better index to the general thought and purpose of parties than either laws and speeches—for the reason that laws are often compromises, and speeches may represent the individual opinions of the speakers rather than the conclusion of the party, while platforms are written by delegates chosen for that purpose.

It will be seen that the party has met with successes and reverses, but it is also noticeable that it has adhered to its principles regardless of the immediate effect of those principles upon it. For instance, it was defeated in 1840, and yet the platform of 1840 was constantly reaffirmed and reiterated for 20 years afterward. The platform of 1892 reaffirmed and even made stronger the platform of 1888, upon which the party had suffered defeat. As the purpose of this article is merely to present as clearly as possible the attitude of the Democratic party on public questions, it would be out of place to enter upon the defense of the party's principles.

It may be said, however, in conclusion, that there is to-day and will continue to be an imperative need for a party thoroughly committed to the defense of the inalienable rights of the individual and to local self-government, and jealous of the encroachments of Federal power. Even when such a party is not in power, it exercises a potent influence in molding public opinion and in restraining excesses, because it is very quick to champion the cause of an individual whose rights have been trespassed upon, or the cause of a community whose rights have been ignored. In proportion as the organization is true to the principles promulgated by Jefferson and defended by Jackson, it may hope to appeal to the confidence of those who seek neither favoritism nor privileges, but are content to enjoy the blessings of a government in which each individual is protected in the enjoyment of life and liberty and in the pursuit of happiness.

*Bibliography.*—Benton, 'Thirty Years' View'; Blaine, 'Twenty Years of Congress'; Cooper, 'American Politics'; Cox, 'Three Decades of Federal Legislation'; 'Jefferson Encyclopedia'; Jefferson, 'Complete Works'; Taylor, 'Cyclopedia of Political Science'; Vincent, 'Platform Text-Book.'

WILLIAM JENNINGS BRYAN.

**Democratic Societies in the United States, 1793.** The masses in this country sympathized with the French Revolution, as essentially the

same with their own, and would have liked an open stand by the government on that side. Instead, the attempt of Edmond Genet (q.v.) to drag the country into an active alliance with France, forced Washington to proclaim neutrality. This irritated popular feeling, and made it worth while for local politicians to organize a faction on the basis of French sympathies, ignoring American questions wholly. It is curious that this basic element of the Democratic or "people's party," which charged the Federalists with being anti-national, monarchic, and a "British party," was itself the only purely foreign party ever known in the United States. In all the considerable towns, clubs were organized in imitation of the Jacobin clubs of France: indeed, that of Charleston openly claimed to be a branch of them, and was formally recognized as such. As usual in such cases, they mimicked ludicrously the outer semblance of their prototypes, without regard to American fitness: wore cockades and liberty caps, called each other "citizen" and "citizenship," held banquets of fraternity, etc. They were at first looked down upon by the "Republicans" or opponents of the Federalists on American questions, who accepted their votes but scorned their antics and irrelevancy; but common political opposition soon forced them into a common organism, which was called Democratic-Republican, still the official name of the party. Washington's denunciation of the societies in 1794, as having fostered the Whiskey Insurrection (q.v.), which in fact they approved, the atrocities of the Reign of Terror, and the final downfall of Robespierre and the Jacobin Club of Paris,—perhaps equally the fact that the craze had become a bore,—caused the general disappearance of the clubs or societies in 1794-5.

**Democritus**, Greek philosopher of the new Eleatic school: b. Abdera between 470 and 460 B.C.; d. 370 B.C. Some Magi and Chaldeans, whom Xerxes left on his return from his Grecian expedition, are said to have excited in Democritus the first inclination for philosophy. After the death of his father he traveled to Egypt, where he studied geometry, and probably visited other countries, to extend his knowledge of nature. Among the Greek philosophers he enjoyed the instruction of Leucippus. He afterward returned to his native city, where he was placed at the head of public affairs. Indignant at the follies of the Abderites, he resigned his office, and retired to solitude, to devote himself exclusively to philosophical studies.

In his system he developed still further the mechanical or atomical theory of his master Leucippus. Thus he explained the origin of the world by the eternal motion of an infinite number of invisible and indivisible bodies, atoms, which differ from one another in form, position, and arrangement, and are alternately separated and combined by their motions in infinite space. In this way the universe was formed, fortuitously, without the interposition of a First Cause. Although denying the presence of design in nature, he admitted that of law. He called the common notion of chance a cover of human ignorance, the refuge of those who are too idle to think. The eternal existence of atoms (of matter in general) he inferred from

## DEMOGEOT — DEMON

the consideration that time could be conceived only as eternal and without beginning. In the atoms he distinguished figure, size, gravity, and impenetrability. Fire consists, according to him, of active globules, and spreads, like a light envelope, round the earth. The soul consists, in as far as it is a moving power, of the finest fire-atoms; but since it is acquainted with the other elements, and anything can be known only by its equal, it must be composed in part also from the other elements. The continuation of the soul after death was denied by Democritus, who divided it into two parts: into the rational part, which has its seat in the breast; and the sensual part, which is diffused through the whole body. Both constitute only one substance. He applied his atomical theory, also, to natural philosophy and astronomy. Even the gods he considered to have arisen from atoms, and to be perishable like the rest of things existing. In his ethical philosophy Democritus considered the acquisition of peace of mind as the highest aim of existence. The purest joy and the truest happiness are only the fruit of the higher mental activity exerted in the endeavor to understand the nature of things, of the peace of mind arising from good actions, and of a clear conscience.

**Demogeot, Jacques Claude**, zhāk klōd dē-mō-zhō, French historian and poet: b. Paris 5 July 1808; d. there 9 Jan. 1894. He wrote a 'Study of Pliny the Younger'; 'Letters and Men of Letters in the 19th Century'; 'French Literature in the 17th Century,' his greatest work. His poetical writings are a drama, 'Romeo and Juliet' (1852); 'New Paris,' consisting of epico-lyric descriptions; and 'Stories and Talks in Verse' (1860).

**Demogor'gon**, dē-mō-gōr'gōn, a mysterious divinity in pagan mythology, viewed as an object of terror rather than of worship. First mentioned by Lactantius (or Lutatius) Placidus in a commentary on Statius, about the 5th century A.D. By some regarded as the author of creation, and by others as a famous magician, to whose spell all the inhabitants of Hades were subjected. In Shelley's 'Prometheus Unbound' it is this dread power of the Demogorgon that overthrows Love.

**Demography, or Demology** (Gr. *demos*, the people, and *graphein* to write, describe), is the science of peoples or of population. This science deals with the ethnical affinities of nations, and the characteristics, physical and intellectual, that result therefrom. This descriptive portion of the science is however quite subsidiary to the economic and statistical object of demography. The increase and decrease of population, and the subsistence obtainable for the support of races, problems such as Malthus discussed, all belong to this science which is more than ever engaging the study of learned men. C. Engels has extended the meaning of the term far beyond the field of mere statistics and has made it to include the political and social idiosyncrasies of races. This opens a wide speculative area, which gives a new importance to the subject. The results of all demographical investigations are such, however, as can be stated in mathematical terms. See Kümelin, 'Zur Theorie der Statistik'; C. Engels, 'Darstellung seines demologischen Systems';

Guillard, 'Éléments de Statistique Humaine ou Démographie comparée.'

**Demoiselle**, dā-mwā-zěl', the Numidian crane (*Anthropoides virgo*), an African bird which visits the south of Europe. It is about three feet in length, and differs from the true cranes in having the head and neck quite feathered and the tertials of the wings elongated and hanging over the tail. It has its name from its gracefulness and symmetry of form.

**Démoivre**, dē-mwāvr, **Abraham**, French mathematician: b. Vitry 26 May 1667; d. London 27 Nov. 1754. He settled in London after the revocation of the Edict of Nantes, and gained a livelihood by becoming a teacher of mathematics. His chief works are: 'Miscellanea Analytica'; 'The Doctrine of Chances, or a Method of Calculating the Probabilities of Events at Play'; and a work on 'Annuities'; besides 'Papers' in the 'Transactions' of the Royal Society, of which he was a Fellow.

**Demon** (Greek, *daimon*), a name given by the ancients to a spirit or genius supposed to hold an intermediate place between men and the celestial deities. In Homer we find the term *daimon* sometimes applied to one or other of the gods; but it is commonly used by him in a general sense, as when we speak of "the Deity" or "Providence." *Daimon* is probably derived from *daiō*, to divide or distribute, though some look upon it as equivalent to *dæmon*, intelligent or wise. Hesiod uses *daimon* in a different sense from Homer. He admitted four classes of rational beings—gods, demons, heroes, and men. A strict classification was not made until the popular belief had been introduced into the schools of the philosophers. Aristotle divides the immortals into gods and demons: the mortals into heroes and men. In the Greek philosophy these demons early played an important part. Thales and Pythagoras, Socrates and Xenophon, Empedocles and the Stoics, invented many fictions concerning them, each in his own way. The poetic Plato, however, goes further than any of the others. In 'The Banquet Dialogue' the character of the demons is thus explained: "Demons are intermediate between God and mortals; their function is to interpret and convey to the gods what comes from men, and to men what comes from the gods; the prayers and offerings of the one, and the commands of the others. These demons are the source of all prophecy, and of the art of the priests, in relation to sacrifices, consecrations, conjurations; for God has no immediate intercourse with men, but all the intercourse and conversation between the gods and mortals is carried on by means of the demons, both in waking and in sleeping. There are many kinds of such demons or spirits." In other places he says of them, they are clothed with air, wander over heaven, hover over the stars, and abide on the earth; they behold unveiled the secrets of the time to come, and regulate events according to their pleasure; every mortal receives at birth a particular demon, who accompanies him until his end, and conducts his soul to the place of purification and punishment. Later writers divided them, in reference to the effects ascribed to them, into good and bad spirits—Agathodemons and Cacodemons. The Romans still further developed the Greek demonology; with

less, however, of a poetical character, and mixed with Etruscan notions.

A full and systematic development of demonism is found in Buddhism, which recognizes six classes of beings in the universe, two only of which, those of men and angels, are good; the other four—the Asuras, irrational animals, Pretas or goblins, and the denizens of hell—are evil. The Asuras are the most powerful of the wicked spirits, and are at constant war with the gods (Devas). They dwell beneath the three-pronged root of the world-mountain, occupying the nadir; while their great enemy, Indra, the highest Buddhist god, sits upon the pinnacle of the mountain in the zenith. With the Asuras are associated numerous groups, as the Rakshasas, gigantic opponents of the gods, terrible ogres with bloody tongues and long tusks eager to devour human beings, and lurking in fields and forests; the Nagas, snakes with human faces; the Mahoragas, great dragons; the Pisatshas or Vampires, etc. According to their nature and office, the different species of demons dwell in the air, the water, or the earth, in holes, dens, or clefts. See *Religion under Egypt*; and also HEBREWS; ZOROASTER.

In the New Testament we find demons, "devils," or "unclean spirits" occupying a prominent place, the Greek word used being generally *daimonion* (a neuter adjectival noun from *daimon*). These spirits are represented as entering into and "possessing" human beings, injuriously affecting them in some strange manner, and as being "cast out" by Christ and his disciples, and even by some among the Jews themselves (Luke ii. 19). Very different views are held regarding these accounts of demoniacal possession. Some regard them as plain statements of fact, believing that "nothing can be more plainly declared than that demons obtained possession of man's soul and body, so as to assert their mastery, and that by our Lord and his agents they were miraculously driven out." "There is every reason to suppose that as the world has become Christian, the powers of evil have been controlled and rendered unable to gain such possession of men as they did in Judæa, and neighboring places, in the time of our Lord and the apostles, and as they are said to do in some parts of the world now. It is believed, moreover, that when Christ was on earth, the Devil put forth his utmost power, knowing that his time was short, and that he was then suffered to put forth a stronger hand than before or since in order that the triumph of Christ might be more conspicuous." These sentences, from Blunt's 'Dictionary of Doctrinal and Historical Theology,' represent what may be called a highly orthodox view of the subject of possession. The same writer admits that "the symptoms of possession, as described in the Gospels, are those of some ordinary diseases, and we have one case which might be put down as confirmed epilepsy with suicidal mania." The Roman Catholic Church teaches that there can be no doubt of the actuality of demoniacal possession. See EXORCISM.

In the opinion of some writers the persons spoken of in the New Testament as possessed of devils were really sufferers from common diseases, being the unhappy victims of madness, monomania, hypochondria, hysteria, epilepsy, and kindred ailments; and that Christ in dealing

with them merely accommodated his language to the prevalent opinions of the time.

However much the first teachers of Christianity participated in the beliefs of their fellow-countrymen respecting the doctrine of spirits, there can be no doubt that their successors, the fathers and teachers of the Church, were considerably influenced by the popular ideas on this subject. In the early Church the "energumens" or persons possessed were recognized as a distinct class, and the Church originated a regular discipline in regard to them. The lives of the saints and holy men and women contain many a story in which demons figure, and the office of exorcist was long one of importance. It did not readily occur to the Jew or early Christian to deny even the existence of the gods of the heathen nations; they were simply regarded as demons or devils. We thus find in literature up till the Middle Ages, and even on this side of them, the divinities of Oriental, classical, and Scandinavian mythology figuring as princes of hell. See such works as Sir Walter Scott, 'Demonology and Witchcraft'; Conway, 'Demonology and Devil-lore'; and for the demons of Scripture the dictionaries of the Bible, as Smith, Hastings, and the 'Encyclopædia Biblica' (Vol. I. 1899); also Horst, 'Dämonomachie' (2 vols. 1818); and 'Zauberbibliothek' (6 vols. 1821-6); Ukert, 'Ueber Dämonen, Heroen, und Genien' (1850); Bastian, 'Der Mensch in der Geschichte' (3 vols. 1860); Taylor, 'Primitive Culture' (2 vols. 1871); Roskoff's admirably learned 'Geschichte des Teufels' (2 vols. 1869); also some of the older books, as Bodin, 'De Magorum Demonomania' (1581); and the like. See ANGEL; ANIMISM; DEVIL; EVIL; EXORCISM; HELL; SERPENT-WORSHIP; WEREWOLF; WITCHCRAFT; ZOROASTER.

**Demonetization.** See BIMETALLISM.

**Demoniac**, a person whose mental faculties are overpowered, and whose body is possessed and actuated by some created spiritual being; especially a person possessed of or controlled by evil spirits. On the other hand there are instances in the histories of every country which go to show that their greatest characters—prophets, seers, and geniuses—have been so called inspired demoniacs. The New Testament has many narratives of demoniacs, and various opinions are entertained in regard to the character of their affliction.

**Demonstration**, a proof in which the conclusion necessarily follows from the premises, and the rejection of the conclusion, therefore, always involves a contradiction. The great domain of demonstration is mathematics, in which all the proofs, however complicated, are drawn from a few simple axioms, founded on intuitive perception of number, time, and space. In ordinary language, however, demonstration is often used as synonymous with proof, and sometimes even more loosely as synonymous with explanation and exhibition, as when we speak of anatomical demonstration. In military tactics it is an operation, specifically, of almost any kind which may be performed to the end of deceiving the enemy in regard to the real measures to be taken against it.

**De Morgan, Augustus**, English mathematician: b. Madura, southern India, 27 June 1806; d. London 18 March 1871. In 1828 he was appointed professor of mathematics in University



## DEMOSTHENES

College, or as it was then called, London University—a situation which he held until 1866, with the exception of the five years from 1831 to 1836. Previous to this appointment he had turned his mathematical attainments to account in the service of some of the London assurance companies, and continued throughout his life the confidential adviser of some of the most important of these associations. Among his many works are: 'Elements of Arithmetic' (1830); 'Elements of Algebra' (1835); 'Elements of Trigonometry' (1837); 'Essay on Probabilities and on Their Application to Life Contingencies and Insurance Offices' (1838); 'Formal Logic' (1847).

**Demos'thenes**, famous Greek orator: b. Athens 384 or 385 B.C.; d. 322 B.C. His father left him a considerable fortune, of which his guardians attempted to defraud him. Demosthenes, at the age of 17 years, conducted a suit against them himself, and gained his cause. He studied rhetoric under Isæus, and benefited in some degree from the teachings of Isocrates and Plato. But nature had placed great obstacles in his way, and his first attempts to speak in public were attended with derision. He not only had very weak lungs and a shrill voice, but was unable to pronounce the letter *r*. These natural defects he endeavored to remedy by the greatest exertions. He succeeded by the advice of the actor Satyrus, who advised him to recite with pebbles in his mouth, on the roughest and steepest places. To strengthen his voice he exercised himself in speaking aloud on the seashore, amidst the noise of the waves. At other times he shut himself up for months in a subterranean room, with his head half-shaved, that he might not be tempted to go out, and endeavored to acquire dignity of manner by practising before a mirror. He is also said to have transcribed the history of Thucydides eight times for the purpose of forming his style. After such a laborious preparation he composed and delivered his masterly speeches, of which his enemies said that they smelt of the lamp, but to which posterity has assigned the first rank among the models of eloquence—speeches in which he openly opposed the foolish wishes of the multitude, censured their faults, and inflamed their courage, their sense of honor, and their patriotism. He thundered against Philip of Macedonia in his orations known as the Philippics, and instilled into his fellow-citizens the hatred which animated his own bosom. The first Philippic was delivered in 352 B.C., when Philip could no longer conceal his ambitious scheme of subjugating the whole of Greece. In 349 the city of Olynthus, the northern ally of Athens, was captured and destroyed by the Macedonians, and shortly afterward Philip took possession of the Pass of Thermopylæ. The orator insisted on the necessity of immediately preparing a fleet and an army; urging the Athenians to begin the war themselves; to make Macedonia the theatre, and to terminate it only by an advantageous treaty or a decisive battle. They admired and approved his plans, but did not execute them. The celebrated Phocion, who knew the weakness of Athens, unceasingly advised peace. Demosthenes went twice to the court of Philip to negotiate, but without success. On his return he recommended war, and endeavored to arm not only Athens, but all Greece. When Philip had finally penetrated into Phocis, through the Pass

of Thermopylæ, and had taken possession of the city of Eletea (338), to the terror of Athens, Demosthenes obtained a decree of the people for fitting out a fleet of 200 vessels, marching an army to Eleusis, and sending ambassadors to all the cities of Greece, for the purpose of forming a universal confederacy against Philip. He was himself among the ambassadors, and prevailed on the Thebans to receive an Athenian army within their walls. He also exerted himself actively throughout Bœotia, and by his efforts a numerous army was collected to act against Philip. A battle was fought near Cheronea, and the Greeks were vanquished. Demosthenes fled, like thousands more. Nevertheless he was desirous of delivering a funeral oration over those who had fallen in battle. Æschines, his rival, did not fail to attack him on this account. The hostility between the two orators was the occasion of the speech 'De Corona' (on the crown), which resulted in the triumph of Demosthenes and the exile of his adversary. Philip having been soon after assassinated, Demosthenes endeavored to rouse Athens to regain her independence, but Alexander's dreadful chastisement of her ally Thebes filled the Athenians with such terror that they sued for mercy. It was with difficulty that Alexander could be persuaded to desist from his demand of the surrender of Demosthenes and some other orators; for the Macedonians feared Demosthenes more than they did the armies of Athens. He was afterward fined 50 talents on a charge of bribery, and being unable to pay the fine, was thrown into prison, from which he escaped and fled to Ægina, where he remained till the death of Alexander. Then followed the war with Antipater. Demosthenes again appeared in public, and endeavored to persuade the small Grecian states to unite against Macedonia. The Athenians received him with honor; but the war was unsuccessful, and Antipater insisted upon his being surrendered to him. Demosthenes fled to the Temple of Poseidon, in the island of Calauria, on the coast of Argolis, but finding himself not secure, he took poison, which he always carried about with him. He died, according to the general account, in 322 B.C., at the age of 60 or 62 years.

The character of Demosthenes is by most modern scholars considered almost spotless. Cicero pronounces him to be the most perfect of all orators. He always spoke as circumstances required, and was by turns calm, vehement, or elevated. He carried the Greek language to a degree of perfection which it never before had reached. In energy and power of persuasion, in penetration and power of reasoning, in the adaptation of the parts to the whole, in beauty and vigor of expression, in strong and melodious language, he surpassed all his predecessors. Everything in his speeches is natural, vigorous, concise, symmetrical. This alone can explain his great influence over his contemporaries. We have under his name 61 orations, 56 exordiums, and 6 letters, some of which are not genuine. Among the oldest editions of the orations the best is that of Paris, 1570, in folio, with the commentaries of Ulpian. The first edition of his complete works, Greek and Latin, was edited by Hieronymus Wolf (Basel 1549). The edition by Bekker (Leipsic 1855) is considered among the best of the modern ones. See Schäfer, 'Demosthenes und seine Zeit.'



**Demot'ic**, or **Enchorial**, **Alphabet**, from the Greek *demōs*, the people, is the name given by antiquarians to that alphabet which is used by the people, in contradistinction to an alphabet used by a certain class or caste; as, for instance, among the Egyptians the 7th century before Christ. We find on the famous Rosetta stone three inscriptions, one in hieroglyphics, one in demotic characters, and one in Greek. According to Champollion the demotic is a simplification of the hieratic, which again was a contraction of the hieroglyphic characters. According to Wilkinson the oldest inscriptions in demotic writing only date from the era of the Ptolemies. The hieroglyphic writing was a mixture of figurative, symbolic, and phonetic characters; the demotic for the most part is made up of the latter. See **HIEROGLYPHIC WRITING**.

**Demot'icos**, or **Demotika**, Turkey in Europe, a town in the province of Rumelia, on the Maritza, 20 miles south from Adrianople. The town has some silk, woolen, and earthenware manufactures. It is the see of a Greek archbishop, and is defended by a citadel, containing a palace, in which several of the Turkish sultans resided before they gained possession of Constantinople. Charles XII. remained here for some time after the disaster of Pultowa. Pop. 8,000.

**Demp'ster**, **Charlotte Louisa Hawkins**, Scottish novelist: b. Forfarshire, Scotland, 1835. She has been a frequent contributor to English periodicals. Her first book was 'The Hôtel du Petit St. Jean: a Gascon Story' (1869); the second, 'Vera' (1872), established her reputation. Her other works include: 'Essays' (1872); 'Iseulte' (1875); 'Blue Roses' (1877); 'Within Sound of the Sea' (1878), a Scottish story; 'Ninette' (1888), an idyl of Provence.

**Dempster**, **Thomas**, Scottish scholar: b. Cliftbog, Aberdeenshire, Scotland, 23 Aug. 1579; d. near Bologna, Italy, 6 Sept. 1625. In France, whither he went at an early period of his life, he represented himself as a man of family (assuming the title of Baron of Muireisk), and possessed of a good estate, which he had abandoned for his religion, the Roman Catholic. He was promoted to a professor's chair at Paris, in the College of Beauvais, and in his latest years was a professor at Bologna. Bayle says that though his business was only to teach a school, he was as ready to draw his sword as his pen, and as quarrelsome as if he had been a duelist by profession; scarcely a day passed, he adds, in which he did not fight either with his sword or at fist-cuffs, so that he was the terror of all the schoolmasters.

Dempster's works are very numerous, and exhibit proofs of great erudition. Among them his 'Historia Ecclesiastica Gentis Scotorum' is the most remarkable, though, instead of being, as its title would indicate, an ecclesiastical history of Scotland, it is merely a list of Scottish authors and Scottish saints. His really most valuable work is 'De Etruria Regali,' an edition of which was published at Florence in 1725.

**Demul'cents**, remedies of a mucilaginous nature that are used in inflammatory conditions of the mucous membrane. They consist largely of mixtures of the oils, gums, and albumins. Thus sweet oil, acacia, tragacanth, marshmallow, slippery elm, white of egg, cream, milk, and

flaxseed are all types of this class of remedies.

**Demur'rage**, in maritime law, is used to signify the amount to be paid by the charterer to the owner of a ship for detaining her in port longer than the time specified. The time of delay in port for a cargo, for convoy, etc., is usually stipulated in the charter-party, and also the allowance to be made in case of longer delay for those objects; and this time is sometimes specified in working days or lay days, as distinguished from holy days, when no cargo can be put on board. All ordinary cases of detention, such as port regulations, the overcrowded state of the harbor, and the like, or even from the unlawful acts of the custom-house officers, are at the freighter's risk, and demurrage must be paid although it is proved that the delay was not caused by any fault of his. But demurrage cannot be claimed when the ship is detained by a public enemy or by the hostile occupation of the port, nor if the detention is caused by the owner, master, or crew. The claim ceases whenever the vessel is cleared and ready for sailing, though she should be detained by adverse winds or rough weather.

**Demur'rer**, a pause or stop put to the proceedings of an action upon a point of difficulty, which must be determined by the court before any further proceedings can be had therein. He that demurs in law confesses the facts to be true, as stated by the opposite party, but denies that, by the law arising upon those facts, any injury is done to the party, or that he has made out a lawful excuse.

A general demurrer is one not specifying an objection, but relies on some defect in substance; a special demurrer specifies some particular defect in the form of the adversary's allegation.

**Demy**, *de-mi'*, a certain size of paper. In America a sheet of writing paper of the size 16 x 21 inches. English writing demy is 15 x 20 inches, while the printing paper there known as demy is 17½ x 22 inches.

**Den** (Anglo-Saxon, *denu*, a valley or woody ground) whenever added to the name of a place, denotes it to be in a valley or near timbered land. Used a great deal in Scotland.

**Denain**, *dé-nân*, France, town in the department of Nord, six miles from Valenciennes, on the left bank of the Scheldt, which is here navigable. It stands in the centre of a coal-field, and both coal and iron are extensively mined, and supply several blast-furnaces and other iron-works. Denain had once a celebrated abbey, founded in 764. A great victory was gained here in 1712 by the French under Villars over the allies under Eugene and Albemarle. Pop. 18,511.

**Dena'rius**, a Roman silver coin, the principal one under the republic and the empire, originally of the value of 10 asses or pounds of copper; but afterward of 16 asses, when the weight of the as was reduced to one ounce in 217 B.C. It was first minted in 269 or 268 B.C. when it weighed 72 grains. It was equivalent to about 16 or 17 cents of United States money. The obverse bore the helmeted head of Roma and the mark of its value X—that is, 10 asses; the reverse had Castor and Pollux upon it. Later other mythological and historical types were cast upon it. It continued to be the or-

## DENBIGH — DENGUE FEVER

inary silver currency down to the age of the Emperor Septimius Severus and his sons, by whom pieces composed of a base alloy were introduced. The name was also given to gold coin struck during the empire; its full title was *denarius aureus*, and it was generally called *aureus*, but by Pliny uniformly *denarius*. It passed for 25 silver *denarii*. Diocletian in 296 A.D. gave the name *denarius* to a coin of copper issued by him. Again, the *denarius* of Tiberius is the penny mentioned in the New Testament.

**Denbigh**, dĕn'bĭ, Wales. (1) A maritime county; area, 425,038 acres. Its surface, minerals, and productions are as in other parts of Wales. Pop. 129,935. (2) A municipal and parliamentary borough, capital of the county of Denbigh. Pop. 6,439.

**Denby, Charles**, American diplomatist: b. Mount Doy, Va., 1830; d. Evansville, Ind., 13 Jan. 1904. He was educated at Georgetown University and Virginia Military Institute and became a lawyer. Having served through the Civil War and attained the rank of colonel, he resumed the practice of law. He was appointed minister to China in 1885 and served for 13 years in Peking. In 1898 he was made a member of the commission to investigate the conduct of the war with Spain, and in 1899 a member of the Philippine Commission. During the war between China and Japan the Japanese government placed its interests in China in his care.

**Denderah**, dĕn'dĕr-ā, Egypt (the Tentyra of the Greeks and Romans), a village on the left bank of the Nile; lat. 26° 10' N.; lon. 32° 40' E.; celebrated for its temple, one of the most magnificent and best preserved remains of antiquity in Egypt, begun under Ptolemy XI. and completed in the reign of the Emperor Tiberius. It was dedicated to the goddess Athor or Aphrodite, and is enclosed within a wall built of sun-dried bricks, in some parts 35 feet high and 15 feet thick. The portico of the temple consists of 24 columns, in three rows four deep on either side, each above 22 feet in circumference, and 50 feet high. The interior consists of a number of apartments, all the walls and ceilings of which are covered with religious and astronomical representations, including the figure of Athor. The roofs are flat, and are formed of oblong masses of stone resting on the side walls, or on rows of columns carried down the middle of the building, and whose capitals are richly ornamented with the budding lotus. The only light admitted to the interior was by small perpendicular holes cut in the ceiling, or by oblique apertures in the sides. The hieroglyphics and ornamentation of the temple belong to the declining period of Egyptian art. The effect of the portico is greatly heightened by the fact of its roof being retained; and on the ceiling is the famous zodiac, at one time regarded as of great antiquity. Another remarkable object belonging to the temple, and which excited the greatest interest, was a celestial planisphere or zodiac, forming the ceiling of one of the upper chambers. This was carefully removed from its original place in 1822, and conveyed to Paris.

**Dendermonde**, dĕn-dĕr-mōn'dĕ, or **Termonde**, Belgium, town in the province of East Flanders, at the junction of the Dender and the Scheldt rivers, 12 miles northwest from

Brussels. It is strongly fortified, defended by a citadel, and surrounded by low, marshy ground which can be laid under water. It contains manufacturing of woollen and linen goods, tobacco, and other articles. It is an important railroad centre. It possesses a college, a public library, an academy of design and architecture, a music school, a number of paintings by Van Dyke and DeCraey, and a remarkably decorated ancient town-hall. Pop. 10,000.

**Dendrerpeton**, dĕn-drĕr'pĕ-tōn, a small lizard-like reptile, discovered by Dawson and Lyell in Nova Scotia; so named from its being found in the interior of a fossil trunk, and hence supposed to have been of arboreal habits. It is now regarded as a labyrinthodont, and is ranked by some scientists under the tribe *Microsauria*.

**Den'drite** (Gr. "tree-like"), any mineral in which arborescent forms resembling trees or mosses occur. These peculiar markings, which are often of great delicacy and beauty, are commonly due to the presence of certain metallic oxides which have separated from the general mass of the mineral. Moss agate is a familiar example of a dendrite, the markings in this case being due to the presence of oxide of manganese. The name "dendrite" is also applied to the complex, tree-like crystalline growths often observed in the case of silver, lead, copper, and certain other metals.

**Dendrobium**, an extensive genus of epiphytes belonging to the order *Orchidacea*, natives of India, where they are found in great numbers in the damp tropical forests. About 200 species are known, of which 80 are cultivated in hothouses. The genus varies greatly in the character of its bloom, some of the species being among the finest of the epiphytes. Among this class are *D. nobilis*, *D. chrysanthemum*, *D. gibsoni*, and *D. densiflorum*.

**Dendrolagus**, a genus of marsupial animals, popularly known as tree-kangaroos, from their habit of living in trees. Their fore legs are not much shorter than the hind ones. Four species are known, one of them (*D. lumholtzi*) being a native of northern Queensland, and the other three (*D. ursinus*, *imustus*, and *dorianus*) natives of the island of New Guinea.

**Den'drophis**, a genus of snakes, family *Dendrophidae*, with smooth scales, which are much larger along the back than on the sides; the sides of the abdomen are slightly keeled. This genus occurs in India, the East Indies, and Australia, and its members are not venomous.

**Dengue** (dĕn gā) **Fever** (also called dandy, breakbone, and three-days' fever, scarlatina rheumatica, abu rokab), a specific disease usually distinguished by an acute onset with fever, intense muscular and joint pains, and later by a measles-like eruption. In some countries it is endemic and has three times assumed pandemic proportions. It is found in Eastern countries — Arabia, China, India, Africa, especially in Egypt and Zanzibar. It has been found in Spain, Greece, and Asia Minor; in Bermuda, the West Indies, the southern United States; in parts of South America; and in Sydney and Brisbane, Australia. It is essentially a disease of the tropics, where it is usually found in hot weather, in the coast and river districts and low levels more than in inland parts; and it would

## DENHAM — DENIS

seem to be a communicable disease, depending upon some micro-organism. As a rule the disease lasts from four to eight days, and the prognosis is favorable. It is frequently confounded with influenza, yellow fever, rheumatism, measles, scarlet fever. Treatment is by means of quinine, ice, the newer antipyretics, and opium. Consult: 'Encyclopedia Medica' (Vol. II.); Manson, in Albutt's 'System of Medicine' (Vol. II.).

**Denham, Dixon**, English explorer: b. London 1786; d. Sierra Leone 9 June 1828. In 1823-4 he was engaged, in company with Capt. Clapperton and Dr. Oudney, in exploring the central regions of Africa. His courage, address, firmness, perseverance, and moderation, his bold, frank, energetic disposition, and his conciliating manners, peculiarly fitted him for such an undertaking. The account of the expedition was prepared by Denham, and published under the title 'Narrative of Travels and Discoveries in Northern and Central Africa' (1826). In 1826 he went to Sierra Leone as superintendent of the liberated Africans, and in 1828 was appointed lieutenant-governor of the colony.

**Denham, Sir John**, English poet: b. Dublin, Ireland, 1615; d. London March 1669. He was the son of Sir John Denham, chief baron of the exchequer in Ireland, and was educated in London and at Oxford. In 1641 he first became known by his tragedy of 'The Sophy.' This piece was so much admired that Waller observed, "Denham had broken out like the Irish rebellion, 60,000 strong, when no person suspected it." In 1643, he published the first edition of his most celebrated poem, called 'Cooper's Hill.' Among the last and best of his productions is a poem in which he commemorated the death of Cowley. His poetry generally is remarkable for its rhythmic flow and smoothness, leading up sometimes to passages of force and dignity.

**Den'hart, or Denhardt, Clemens and Gustave**, German explorers: b. Zeitz 1852 and 1856, respectively. They made a tour in 1878, through the Tana River region, East Africa, to establish German trade, and another from the Island of Lamu to Vitu in March 1885, the sultan of the Swahili desiring a treaty with Germany. Clemens Denhart transferred part of the territory acquired by him to the German Colonist Society, the Deutsche Witugesellschaft. All rights to this territory were ceded by Germany to England in 1890, in exchange for the island of Helgoland, the brothers receiving an indemnity of 150,000 marks from the German government.

**Denina, Carlo Giovanni Maria, kār'lō jō-vān'nē mā-rē'ā dā-nē'nā**, Italian historian: b. Revello, Piedmont, 28 Feb. 1731; d. Paris 5 Dec. 1813. He studied at Turin, in 1758 became an extraordinary professor in the university there, and in 1770 full professor. In 1769 he published the first three volumes of his 'History of the Italian Revolutions,' his most important work. He went to Berlin in 1782, and was appointed a member of the Academy. He published 'La Prusse littéraire sous Frédéric II.'; 'Political and Literary History of Greece'; and 'Letters from Brandenburg'; etc. His 'Clef des Langues,' dedicated to Napoleon, brought him the position of librarian to the emperor.

**Deni'o, Hiram**, American jurist: b. Rome, N. Y., 21 May 1799; d. Utica 5 Nov. 1834. He studied law, was admitted to the bar, and practised at Rome and Utica. He was appointed circuit judge of the Fifth New York circuit, and was three times elected judge of the State court of appeals, the first time in 1853. He retired from that office in 1866. He edited with William Tracy 'Revised Statutes' of New York (1852), and published 'Reports of Cases Argued and Determined in the Supreme Court and in the Court for the Correction of Errors' (5 vols. 1845-8).

**Denis, Fr. dé-nē, or Denys, Saint, or Dionysius, Saint**, first bishop of Paris, and patron saint of the French nation. Exact information regarding Saint Denis cannot be obtained, but there is no doubt he belongs to the 3d century. In the Middle Ages it was believed by many that Saint Denis, or Dionysius, of Paris was the same as the Dionysius converted at Athens by Saint Paul; but the number of years intervening between the time of Saint Paul and when Saint Denis was bishop of Paris (about 207 years) is proof that the Areopagite of Athens and the apostle of Paris were not the same person.

The most reliable authorities say that Saint Denis of Paris was sent by the Pope to Gaul about 250 A.D. His mission was most successful and many pagans were converted to Christianity. The number of his disciples attracted the attention of the Roman governor who caused the arrest of Denis and several of his companions, among whom were Eleutherius, a deacon, and Rusticus, a priest. The Christians, refusing to denounce Christ and offer sacrifice to the gods, were tortured and put to death. The bodies of Denis, the priest, and the deacon were thrown into the Seine. Catulla, a Christian woman, recovered the bodies and gave them burial. Later a church was built over the place where the bodies were interred. Dagobert I. built (about 636) here the Abbey of Saint Denis. His feast, in the calendar of the Roman Catholic Church, is 9 October. Consult: Butler, 'Lives of Saints'; Tailliar, 'Apostolate of Saint Denis'; Vereilly, 'Vie de Saint Denis.'

**Denis, St., sǎn dé-nē**, France, town in the department of the Seine, six miles north of Paris, lying within the lines of forts surrounding the capital. It has numerous manufactories of calicoes and other printed cotton goods, gelatine, candles, saltpetre, and soda. In the latter part of the 3d century a chapel was erected on or near the present site to the memory of St. Dionysius or Denis, who is said to have been martyred here. For this chapel Dagobert I., in the 7th century, substituted a large basilica, in which he himself was interred, and afterward it was used as the burial place of the kings of France. Changes were made later but under the Abbot Suger the building became most beautiful. The chapel was destroyed during the Revolution and the bodies of the kings put into a cannon pit. Many of the tombs and relics were, however, preserved in the Musée des Petits Augustins. Napoleon's decree of 20 February 1806 made St. Denis again the burial place of the reigning family of France. Louis XVIII. obliterated from St. Denis all traces of Napoleon's rule; but under Napoleon III. the famous architect Viollet-le-Duc effected a mag-

nificent restoration of the ancient building. The present stained-glass windows are all modern but one. Pop. 53,653.

**Denison, Charles Wheeler**, American poet and prose writer: b. New London, Conn., 11 Nov. 1809; d. 14 Nov. 1881. He published: 'The American Village and Other Poems' (1845); 'Out at Sea,' poems (1867); 'The Child Hunters' (1867); and a series of biographies: 'The Tanner Boy' (Grant); 'Winfield the Lawyer's Son' (Hancock); etc.

**Denison, Frederic**, American clergyman: b. Stonington, Conn., 28 Sept. 1819; d. Providence, R. I., 16 Aug. 1901. He was graduated from Brown in 1847; was chaplain in the Union army during the Civil War, and held several pastorates. He has written: 'The Supper Institution'; 'The Sabbath Institution'; 'Notes of the Baptists and Their Principles in Norwich, Conn.'; 'Westerly and Its Witnesses'; 'History of the First Rhode Island Cavalry'; 'Picturesque Rhode Island.'

**Denison, George Taylor**, Canadian soldier: b. Toronto 31 Aug. 1839. He was educated at Upper Canada College and Toronto University, was called to the bar in 1861, and practised law in Toronto, in 1877 being appointed police magistrate of the city. In 1872 and 1873 he was sent to England as commissioner in behalf of immigration. He began his military service in 1855 and was made lieutenant-colonel in 1866; he was in active service in the Fenian raid of 1866 and in the Riel rebellion in the Northwest Territory in 1885. His 'History of Cavalry' (1877) won the first prize offered by the emperor of Russia for the best book on the subject; he has written also: 'The National Defenses' (1861); 'Canada, Is She Prepared for War?' (1861); 'The Fenian Raid at Fort Erie' (1866); and 'Canada and Her Relations to the Empire' (1895). He was one of the founders of the "Canada First" party, and through his contributions to periodical literature and public addresses has been known as an earnest advocate of Canada's rights and of the preservation of the unity of the empire.

**Denison, John Evelyn**, English politician, for 14 years speaker of the British House of Commons: b. Ossington, Nottinghamshire, 27 Jan. 1800; d. 7 March 1873. Educated at Eton and Christ Church, Oxford, he entered Parliament in 1823, and was a lord of the Admiralty 1827-8. In 1872 he retired from the speaker's chair, and shortly after was created Viscount Ossington. He was a D.C.L. of Oxford; and it was on his suggestion that the "Speaker's Commentary" to the Bible was undertaken.

**Denison, John Henry**, American Congregational clergyman: b. Boston, Mass., 3 March 1841. He was college pastor at Williamstown for five years, and is the author of 'Christ's Idea of the Supernatural' (1895).

**Denison, John Ledyard**, American writer: b. Stonington, Conn., 19 Sept. 1826. He has published: 'Pictorial History of the Wars of the United States' (1859); 'Illustrated History of the New World' (1872); 'Pictorial History of the Navy of the United States' (1860).

**Denison, Mary Andrews**, American author: b. Cambridge, Mass., 26 May 1826. She married Charles Wheeler Denison (q.v.) in 1846 and became connected with the 'Olive Branch'

of which he was on the editorial staff. Contributing frequently to the American and later to the English magazines, she wrote sketches of native life while living in British Guiana, where her husband was American consul. Among her numerous works are: 'Home Pictures' (1853); 'Gracie Amber' (1857); 'Old Hepsy, a Tale of the South' (1858); 'Opposite the Jail' (1858); 'The Lover's Trials' (1865); 'Annie and Teely' (1869); 'That Husband of Mine' (1874), which sold more than 200,000 copies in a short time; 'That Wife of Mine' (1877); 'Rothmell' (1879); 'Mr. Peter Crewelt' (1878); 'His Triumph' (1883); 'What One Boy Can Do' (1885). She has also written many Sunday-school books.

**Denison, Iowa**, city, county-seat of Crawford County; on the Boyer River, and on the Chicago & N., and the Illinois C. R.R.'s; about 100 miles west by north of Des Moines. Flouring mills and creameries are the chief manufactories. It is the site of one of the Denison Normal and Business schools, a private institution. Pop. (1900) 2,771.

**Denison, Texas**, city in Grayson County, on the Missouri, K. & T., the Houston & T. C., and the Texas & P. R.R.'s; 106 miles north of Dallas. It is a noted cattle-shipping place; the trade centre of the surrounding agricultural country, including the Indian Territory; and an important railroad point. It has manufactories of cotton, iron, and machinery, daily and weekly papers, high school, electric lights, waterworks, two national banks, St. Francis Xavier's Academy, and the Washington School. It was settled in 1872 and is now governed under a charter of 1893. Pop. (1902) 12,986.

**Denison University**, an educational institution in Granville, Ohio; founded in 1831, under the auspices of the Baptist Church, and intended at first as a manual training school. The manual training was soon abandoned, and the theological department was dropped in 1870. The Shepardson College for Women, established in 1887, became affiliated with the university in 1900. In 1902 the library contained about 22,000 volumes, and the attendance was 500.

**Denitrification**. See NITRIFICATION.

**Denizen**, in English law, an alien who by letters patent has been constituted a British subject permanently or for a time. A denizen is in a middle state between an alien and a natural born or naturalized subject. He may take lands by purchase, or derive a title by descent through his parents or any ancestor, though they be aliens. No denizen can sit in Parliament, or take office, civil or military.—In natural history, an animal or plant originally introduced into a country or district by human agency, which now maintains itself there without the direct aid of man, is called a denizen of that country or district.

**Den'man, Thomas**, BARON, English jurist: b. London 23 Feb. 1779; d. 22 Sept. 1851. He was associated with Brougham in the courageous defense of Queen Caroline (1820), and shared his consequent popularity. He sat in Parliament in 1818-26, and was attorney-general in Earl Grey's administration in 1830-2; succeeded Lord Tenterden as lord chief justice of England in 1832; and was raised to the peerage in 1834. He retired from the bench in 1850.

## DENMARK

**Denmark** (Danish, *Danmark*), a northern kingdom of Europe, between lat. 54° 40' and 57° 45' N., and lon. 8° 4' and 12° 45' E. It is composed of a peninsular portion, and an extensive archipelago, lying east of it, with a few scattered islands on its west side; and is bounded north by the Skager Rack, which separates it from Norway; northeast and east by the Cattegat and Sound, which separate it from Sweden; east and south by the Baltic; south by the duchy of Sleswick; and west by the German Ocean or North Sea. The peninsular portion is composed of Jutland, and measures, north to south, 185 miles with a breadth varying from 40 to 108 miles—its broadest part being from Fornæs Point, lat. 56° 26' 42" N., on the east coast, to Nissum Fiord on the west coast. The numerous islands lying east of Jutland are mainly comprised in two groups:—first, that of Sjælland, Seeland or Zealand, including, besides the large island of that name, the small adjoining islands east of the Great Belt, the principal of which are Amager, Langøe, Tarøe, Masnedøe, Agersøe, Lolland or Laaland, Falster, and Møen, and second, the Fünen or Fyen group, comprising, besides the large island of that name, the neighboring islands west of the Great Belt, including Langeland, Aerøe, Fanøe, Taasinge, and others. Besides these, there are the outlying islands of Lessøe and Anholt, in the Cattegat, and Bornholm in the Baltic.

Besides these territories, Denmark possesses the Färøe Islands and Iceland, in the North Atlantic Ocean; Greenland, in the Arctic regions; the islands of Santa Cruz or Saint Croix, Saint Thomas, and Saint John, in the West Indies. She also formerly had some establishments on the coasts of Guinea, in Africa, and of Coromandel, in India; but these have been sold to Great Britain.

For administrative purposes Denmark is divided into 18 counties (*Amter*), each county being subdivided into *Herreder* or hundreds. Copenhagen is the capital, and among the towns of importance are Aarhus, Odensee, and Aalborg.

The following table gives the main divisions of the country, with their area and population, as well as the total area and population of the whole monarchy, according to the census of 1 Feb. 1901:

DIVISIONS	Area Eng- lish sq. m.	Population 1901
City of Copenhagen (Kjöbenhavn) without suburbs.....	21	378,235
Islands in the Baltic.....	5,062	1,007,513
Peninsula of Jutland.....	9,765	1,063,792
Färøe Islands (17 inhabited)...	512	15,230
Total.....	15,360	2,464,770

Previous to 1864 the duchies of Schleswig-Holstein and Lauenburg belonged to Denmark, so that the area of the kingdom was then greater by about 7,360 square miles, the corresponding population being more than a million.

**Geology and General Aspect.**—Denmark is a very low-lying country, there being no elevation of any consequence throughout the whole kingdom. The greatest height is attained on the eastern side of the peninsula, though even there it never exceeds 550 feet. In respect of geological structure all the rocks belong to the upper series of the Secondary, and to the Tertiary

formation, and have been deposited from water in regular strata. The rock most fully developed is the chalk, of which several distinct species have been recognized. The whole west coast is rendered almost uninhabitable by the drift-sand, which has formed an almost uninterrupted line of sterile downs, called *Klitten*, extending from Cape Skagen to Blaavands Hook, a distance of nearly 200 miles. Along parts of the coast of Jutland are extensive flats or plains, which have been wrested from the sea, and which are protected from its encroachments by huge dykes, as in Holland.

**Rivers, Lakes, Sea-arms, Ports, etc.**—Denmark has no large rivers; the principal is the Guden, which is navigable for part of its course. Less important streams are the Holm, the Lönborg, and the Stor Aa. All the others are insignificant streams. There are no rivers in any of the islands, but brooks and streamlets abound. There are a number of lakes, particularly in Jutland, and several in the larger islands; but they are all small. The most remarkable of the physical features of Denmark are its lagoons or fiords, winding inlets of the sea, that penetrate far into the land. The largest of these is the Lymfiord, or Liim Fiord, in Jutland, which, entering the land in the Cattegat, winds its way quite through the peninsula, and is separated from the North Sea merely by a narrow strip of land which storms have ruptured in one or two places. Most of the streams, lakes, and coasts of the kingdom are well stocked with fish. Besides these inland seas, the Great Belt separates the large islands of Seeland and Fünen, and the Little Belt flows between the latter and the coast of Jutland and Schleswig. Denmark is well supplied with excellent seaports, the most important being Copenhagen, Aalborg, Aarhus, and Randers.

**Climate.**—The prevailing characteristic of the climate of Denmark is humidity; it is also remarkably temperate for so northerly a region; both the result of the lowness of the land and of its proximity to the sea on all sides. The heats of summer are great, sometimes excessive. The mean temperature of the year is 47°. The shortest day is about 6½ hours, the longest 17½ hours.

**Animal and Vegetable Products.**—Horses and cattle are reared in great numbers, and both are excellent. Large flocks of sheep are kept; but rather for the flesh than the wool, which is coarse and short. Swine are also reared to a great extent. Deer, stags, roes, hares, and a variety of other game are met with in the royal and other forests, but do not abound anywhere else. Wild fowl—including the eider-duck, so famous for its down—are numerous. Poultry of all kinds are raised, particularly geese. Potatoes, barley, oats, rye, beans, pease, tares, flax, hemp, madder, and tobacco are raised; wheat in Laaland and buckwheat in Fünen. Among the garden fruits are apples, plums, cherries, pears, and nuts. Few of the great forests with which the country was once covered now remain. Government, however, has of late years paid some attention to this source of national wealth, and has taken measures for the protection and better management of the forests. The larger forests are now confined to the east side of Jutland and to Seeland.

**Agriculture, Cattle Breeding, etc.**—Although not particularly favored by nature, Denmark is



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yet pre-eminently an agricultural country. Of the total area 80 per cent is productive; about one sixth of the unproductive area is bog. The land is greatly subdivided, as the law interdicts the union of small farms into larger, and encourages the division of landed property. The kinds of grain most largely cultivated are barley, oats, rye, and wheat, the greatest area being occupied by oats, the second by barley. Rye is grown throughout the whole peninsula, and in the islands of Fünen and Seeland, and some of the islands on the west coast. From this grain the greater part of the bread used in Denmark is made. Wheat, which occupies but a comparatively small area, is grown chiefly on the islands of Laaland and Langeland, and on large estates in other quarters of the kingdom. The yearly yield of the cereal crop is said to be larger than that raised by any corresponding European population except that of Mecklenburg. The oats crop of 1898 amounted to 39,920,052, the barley crop to 21,048,564, that of rye to 15,328,240, and that of wheat to 2,878,120 bushels. The value of these crops was estimated at \$48,856,830, the total value for all crops for that year being \$91,091,910. Buckwheat is cultivated to some extent in Jutland, as also in the island of Fünen and elsewhere. Potatoes, which were introduced into Denmark early in the 19th century, are now very generally cultivated. Herbage plants and grass are carefully cultivated. Beans, pease, and tares are also extensively cultivated throughout the whole country and form an important article of food. Flax, hemp, hops, tobacco, madder, lavender, and mustard-seed are grown, but not in sufficient quantities to supply the home demand. The part of the kingdom best adapted for the production of fruit is the island of Fünen. Cattle-breeding, grazing, and the dairy engage the greatest share of the farmer's attention in Denmark. Large and increasing numbers of cattle are annually exported from the country. A great increase has of late years taken place also in dairy produce, and the export of butter is now the main source of the wealth of Denmark. The rearing of horses is extensively carried on. The old Danish breed is found chiefly in Jutland. Those from the islands are said to be of Tartar descent, and are small, but strong and active. Sheep-rearing is on the decline in Denmark. Eggs are now largely exported, and the rearing of hogs is much attended to; the greatest number are reared in the vicinity of the woods in East Jutland. The rearing of bees occupies a large share of attention, particularly in the island of Fünen, and wax is largely exported.

*Fisheries.*—The fisheries are an important branch of national industry. Next to the herring the turbot, torsk, and salmon are the most abundant sorts of fish. Oyster banks occur on the east coast of Jutland, near its northern extremity, and near the island of Lessøe. Fish-ponds were at one time very general over the country, and were profitable. The seal fisheries of Denmark are considerable, the principal station being the island of Anholt.

*Manufactures.*—These are comparatively insignificant, and do not comprise any peculiar or national manufacture. There are, however, one or two articles which have attained a considerable reputation; these are the woollens and earthenware of Jutland, the former a domestic manufacture; the wooden clocks of Bornholm, and a superior kind of stove made in Copenhagen.

The manufacture of paper is pretty extensive, and has of late years been greatly improved and extended. There are also iron-foundries, sugar-refineries, some extensive tanneries, and many distilleries. Randers in Jutland, and Odensee in the island of Fünen, were formerly celebrated for the manufacture of gloves; but the peculiar kind of leather from which they were made, and in which their excellence consisted, is now prepared in other countries. The people of Denmark bake their own bread, brew their own beer, and spin the greatest portion of the woolen yarn afterward knitted into stockings or woven into cloth by the village weaver. The women make up their own dresses, and frequently the clothes of their husbands; the latter make the wooden shoes and slippers, and manufacture the greater part of the house furniture and farming utensils. Several of the manufacturing establishments of Denmark belong to the government. Among these establishments are a royal porcelain manufactory in Copenhagen, and a royal cloth manufactory in Irsserød, which supplies cloth for the army.

*Commerce, Canals and Railways.*—The commerce of Denmark is carried on chiefly with Great Britain, Germany (especially Sleswick-Holstein), Norway, Sweden, and Russia, Great Britain and Germany possessing by far the largest share. The chief imports are textile goods (especially cottons), metals and hardware, wood and articles made of it, coal, bricks, salt, manure, oil, oil-cake, fish, rice, coffee, fruit, glass-ware, paper. The principal imports are cotton manufactures, coal, and iron. Considerable quantities of cottons are imported by Denmark from Germany. The manufactures of Denmark being, as already mentioned, insignificant, the articles exported consist chiefly of agricultural products. The declared value of the total imports in 1876 amounted to \$63,583,790, and that of the exports to \$50,185,285; in 1898 they were \$126,386,115 and \$89,602,770 respectively. In 1898 the mercantile marine of Denmark consisted of 3,696 vessels, with a total tonnage of 356,108 tons. The coasting trade is extensive, and is largely shared in by foreigners. There are several canals in Denmark, but none of them of any great consequence. The country is now pretty well supplied with railroads, there being lines running across the islands of Seeland, Fünen, Laaland, and Falster, which, assisted by ferries, gives direct communication with the capital on the one hand and with Jutland on the other.

*Moncys, Weights, etc.*—Since 1 Jan. 1875, the unit of the Danish monetary system has been the *krona* or crown, equal to about 28 cents. The krona is divided into 100 *öre*. The commercial pound weight is heavier than the United States weight of that denomination, 100 pounds Danish being equal to 110¼ pounds avoirdupois. The weight of 100 pounds Danish is known as the *centner*. The principal measure used throughout Denmark for corn is the barrel or *toende*, which contains 7,776 Danish cubic inches or 8,488 English cubic inches, and consequently is equal to nearly four bushels. The *viertel*, used for wine and liquor, is equal to 1.7 gallon. The standard measure of length is the foot, which equals 12.356 inches. The Danish mile is 4,684 English miles. 16 Danish square feet are nearly equal to 17 English square feet. A tonne or *toende* of land is as much land as can be



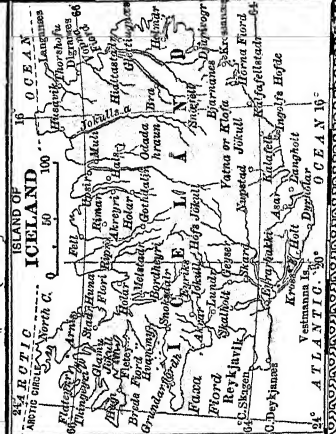
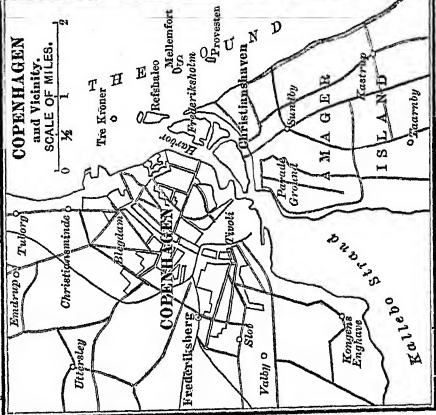
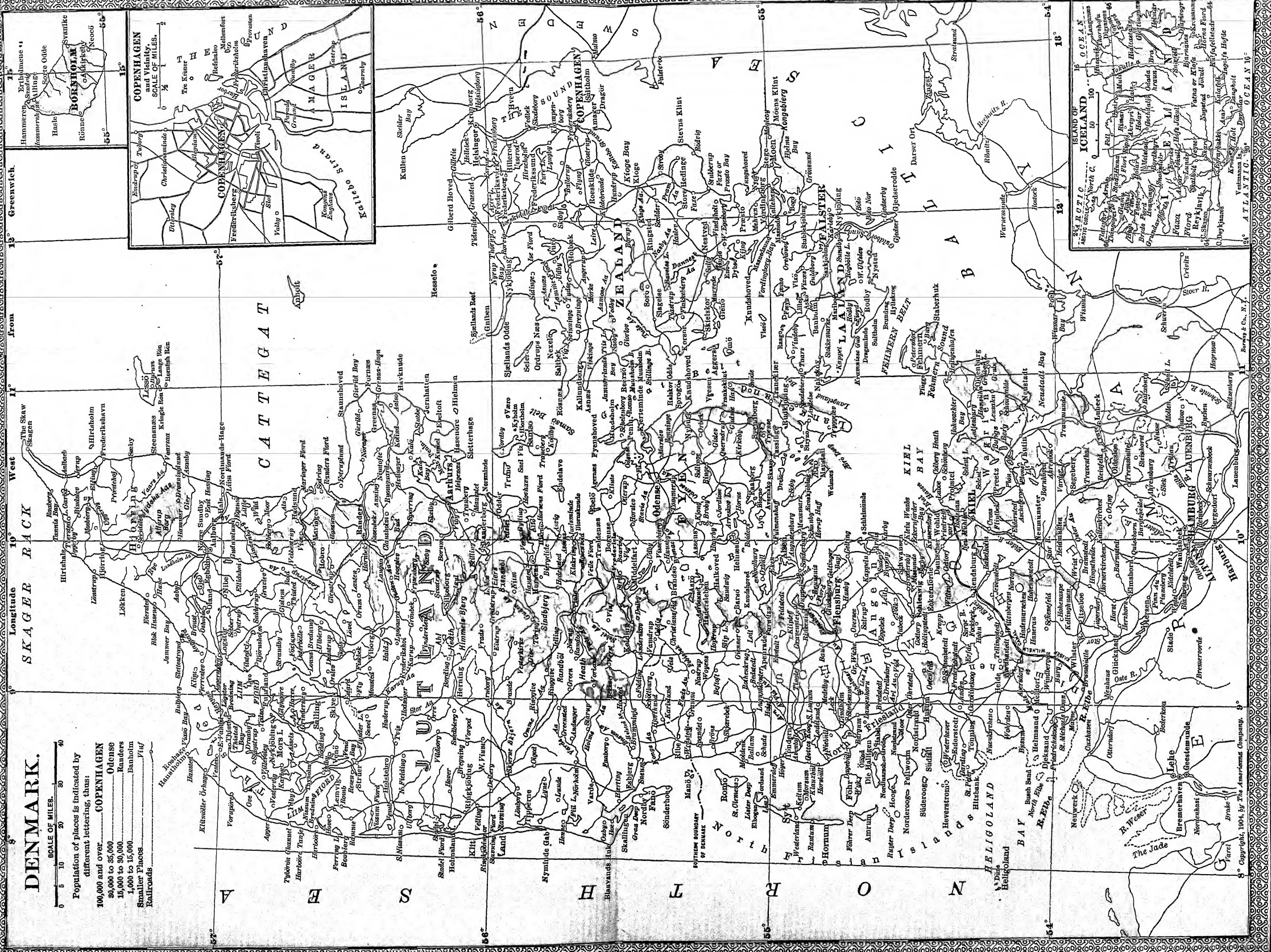


# DENMARK.

SCALE OF MILES. 0 5 10 20 30 40

Population of places is indicated by different lettering, thus:

100,000 and over COPENHAGEN  
50,000 to 100,000 Odense  
15,000 to 50,000 Randers  
1,000 to 15,000 Smaller Places  
Railroads





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sown with one toende of rye, one of barley, or two of oats, and is equal to 1.36 acres.

*People, Education, Religion.*—The population of Denmark is composed almost exclusively of Danes, with a few thousand Jews and others. The Danes have regular and well-formed features, fair or brownish hair, and blue eyes, with muscular frames; they are kind-hearted, honest, and simple-minded, and continue to maintain their ancient reputation of being bold and hardy seamen. All classes are noted for their hospitality, which is indeed a characteristic of the nation. At the head of the educational institutions stand the University of Copenhagen and the Holberg Academy at Sorø. Elementary education is widely diffused, although in this regard Denmark is no longer so pre-eminent as formerly; it is compulsory for children between the ages of 7 and 14 years, poor parents paying only a nominal sum toward the government or parochial schools, of which there are about 3,000. There are training colleges for teachers, and classical and other higher education is afforded by a large number of colleges in the more important towns, with the university of Copenhagen (1,300 students) for the centre of the entire system. Denmark has also a theological seminary, a royal surgical college, a veterinary and agricultural school, and numerous military, technical and commercial schools, while 50 "people's high schools" provide instruction in agricultural subjects. There are three public libraries in Copenhagen, of which the Royal Library, with 500,000 volumes, is especially rich in Oriental and Icelandic MSS. The established religion is Lutheran, to which the king must belong; but complete toleration is enjoyed in every part of the kingdom. The Reformation was introduced in 1536, when the Church revenues were seized by the crown. Denmark is divided into seven dioceses, in which there are 1,360 parishes. There are only 31,000 persons not belonging to the Lutheran Church, of whom 4,000 are Jews, 3,600 Roman Catholics, 2,300 Methodists, 1,000 Mormons, 4,600 Baptists, and 2,600 Irvingites.

*Government, Army and Navy, Finance.*—The government of Denmark is a constitutional monarchy, the king being assisted by a cabinet of seven ministers. The crown was elective until 1660, when the people and clergy, impelled by hatred toward the nobles, invested the sovereign (Frederick III.) with absolute power, and declared the succession to the throne hereditary. From that time the crown exercised absolute rule till 1831, when a constitution was granted. This proving unsatisfactory, was superseded in 1848 by the form of government which, with some alterations, Denmark now enjoys. The national assembly or Rigsdag consists of the Folkething and Landsting, which meet annually, the members receiving a fixed allowance during their sittings. The Landsting is composed of 66 members, of whom 12 are nominated for life by the king, while the remainder are elected for a term of eight years by certain bodies representing the large taxpayers of the kingdom. The members of the Folkething, whose number is fixed by statute in the proportion of one to every 16,000 of the population, are elected for three years by practically universal suffrage. To this body all budgets must first be submitted; but in the years 1877-87, when the government had a minority in the lower house, the king was in-

duced to give the royal ratification to successive "provisionary budgets," which had never received the assent of the Rigsdag. Nevertheless the financial condition of Denmark is sound and prosperous. The total revenue in the period 1885-95 fluctuated from \$15,000,000 to \$16,000,000 a year; while the expenditure has repeatedly exceeded \$18,000,000. Since the war of 1866, the government has maintained a comparatively large reserve fund to meet any sudden emergency. That fund stood in 1887 at \$4,950,000. The total national debt is over \$50,000,000, or about \$25 per head of the population; but as the investments of the state (in telegraphs, etc.) amount to nearly \$25,000,000, this proportion is reduced to less than \$15. The decimal system was introduced in 1875, the unit being the *kroner*, or crown, of 100 *øre*; the average rate of exchange is 3.6 *kroner* to the dollar. The Danish army numbers 1,200 officers and 46,000 men, inclusive of the landwehr; but only a sufficient establishment for garrison purposes is maintained, and the peace strength is 750 officers and 13,000 men. The total war strength is about 50,000 men, to which an extra reserve of 14,000 could be added on emergency. Conscription prevails, and the period of military service is divided into eight years in the line and reserve, and eight in the extra reserve. The navy is recruited by levies from the coast districts. The fleet comprises some 40 steamers (of which 10 are ironclads, but only one a first-class battleship). The navy numbered in 1888, 134 officers and 1,477 men. There were in 1897, 290 officers and 1,150 men. Besides Copenhagen (q.v.), there are no defensible fortresses, though there are antiquated forts at Helsingör (Elsinore) and Fredericia. The arsenal is at Copenhagen.

*History.*—The early history of Denmark is lost in the twilight of the saga-period, out of which loom dimly the figures of its heroes, their brave deeds, and daring voyages. Within its borders the Celts had first their home, and from its shores the Angles and Saxons sailed in the 5th century to the conquest of England; while in their place the Danes from Zealand settled on the deserted lands, extending their sway as far south as the Eider. One of their earliest kings, Harald Hildetand, fell in battle against the Swedes in 695; and shortly afterward a branch of the Ynglinger occupied Jutland, where they held a footing for two centuries. One of their kings, Harald Klak, received baptism in 826 from Ansgar, but the introduction of Christianity did not at once place any check on the long accustomed inroads on Frankish territory, or on the piratical expeditions of the Vikings; although the country was soon torn by dissensions between the adherents of the old and new faiths. Gorm the Old, who drove the Ynglinger from the peninsula, and first united the mainland and islands under one rule, was the bitter enemy of Christianity; and although his death in 936 gave fresh vigor to the diffusion of the new faith, yet even its ultimate success was only insured by the zealous support it received from Gorm's grandson, Canute. On his death in 1035 the three kingdoms of his Anglo-Scandinavian empire separated, and his sister's son, Svend Estridsen (1047-76), ascended the throne of Denmark, founding a princely line that flourished 400 years. Internal dissensions and external wars weakened the country, and the introduction of a feudal system raised up a powerful nobility,

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and ground down the once free people to a condition of serfdom. Waldemar I. (1157-82) added Rügen to the other Wendish districts of Mecklenburg and Pomerania, and extended his sway over Norway also. Under Waldemar II. the conquests of Denmark extended so far into German and Wendish lands, that the Baltic was little more than an inland Danish sea. The jealousy of the German princes and the treachery of his vassals combined to rob him, however, of these brilliant conquests, and his death in 1241 was followed by a century of anarchy and inglorious decadence of the authority of the crown, during which the kingdom was brought to the brink of annihilation. Under his great-grandson, Waldemar IV., Denmark made a transient recovery of the conquests of the older Waldemars, rousing the jealousy of the Hanseatic League, and the national laws were codified. From his death in 1375 to 1412, his daughter, the great Margaret, widow of Hakon VI. of Norway, ruled not only that country and Denmark, but in course of time Sweden also, with so light yet firm a hand that for once in the course of their history the three rival Scandinavian kingdoms were content to act in harmony. Margaret's successor, Eric, the son of her niece, for whose sake she had striven to give permanence, by the act known as the Union of Calmar (1397), to the amalgamation of the three sovereignties into one, undid her glorious work with fatal rapidity, lost the allegiance and the crowns of his triple kingdom, and ended his disastrous existence in misery and obscurity. After the short reign of his nephew, Christopher of Bavaria (1440-8), the Danes exerted their ancient right of election to the throne, and chose for their king Christian of Oldenburg, a descendant of the old royal family through his maternal ancestress, Rikissa, the great-granddaughter of Waldemar II. Christian I. (1448-81), who was at the same time elected Duke of Sleswick and Holstein, was the founder of the Oldenburg line, which continued unbroken till the death of Frederick VII. in 1863. His reign was followed by half a century of international struggles in Scandinavia. The insane tyranny of Christian II. cost that monarch his throne and freedom; the Danes chose his uncle Frederick I. to be their king, while Sweden was forever separated from Denmark, and rose under the Vāsas to be a powerful state. (See GUSTAVUS I.).

Under Christian III. (1536-59), the Reformation was established in Denmark. Christian IV. after his brief share in the Thirty Years' War, proved one of the ablest of all the Danish rulers. His liberal and wise policy was, however, cramped in every direction by the arrogant nobles, to whose treasonable supineness Denmark owes the reverse by which she lost (1658) all the possessions she had hitherto retained in Sweden; and with the relinquishment of these, and consequently of the undivided control of the passage of the Sound, the country's former international importance came finally to an end. The national disgraces and abasement which followed led, in 1660, under Christian's son, Frederick III., to the rising of the people against the nobles, and their surrender into the hands of the king of the supreme power. For the next hundred years, chiefly marked by wars with Sweden, the peasantry were kept in serfdom, and the middle classes depressed; but by the end of the 18th century the peasants had been gradually eman-

cipated, while many improvements had been effected in the mode of administering the laws, and the Danish kings, although autocrats, exercised a mild rule. The miseries of the reign of Frederick VI., who governed as regent from 1784, brought the country to the verge of ruin. Denmark having joined Russia in a compact of the northern powers hostile to England, a fleet was sent into the Baltic, and considerable injuries were inflicted by an attack on Copenhagen, in 1801, under Parker and Nelson. From this the country rallied; but in 1807 the British government, suspicious of an intention on the regent's part to violate his neutrality and take sides with Napoleon, demanded the surrender of the entire Danish navy, to be restored at the conclusion of peace. A refusal was followed by the bombardment of Copenhagen in September, 1807, and the fleet was given up; but this treatment drove Denmark into Napoleon's arms, and with him the kingdom was obliged to co-operate until the close of 1813.

By the congress of Vienna, Denmark was compelled to cede Norway to Sweden. From this period a spirit of discontent grew up in the duchies, degenerating into mutual animosity between the Danish and German population, which led to an open rupture with Denmark in 1848, immediately after the accession of Frederick VII. (For the whole question, see SLESWICK-HOLSTEIN. After alternate hostilities and armistices, the war was virtually concluded in 1850, by the victory of the Danes at Idsted; but in 1863 the quarrel was renewed. On the death of Frederick in that year, Prince Christian of Sleswick-Holstein-Glücksborg ascended the throne under the title of Christian IX., in conformity with the act known as the Treaty of London of 1852, by which the succession to the Danish crown had been settled on him and his descendants by his wife, Princess Louise of Hesse-Cassel, niece of King Christian VIII. of Denmark. A pretender, backed by German influence and help, at once started up in the person of the eldest son of the Duke of Augustenborg, who assumed the title of Duke Frederick VIII. of Sleswick-Holstein; but his cause was speedily merged and lost sight of by Prussia and Austria in their direct aim of incorporating the duchies with the German Confederation. Denmark, unaided by England and France, allies on whose support she had relied, was forced to go single-handed into the unequal contest. After a brave but utterly futile attempt at resistance, the Danes found themselves forced to submit to the terms dictated by their powerful foes, and resign not only Lauenburg and Holstein, but the ancient crown-appanage of Sleswick. By the peace of Vienna, 1864, the Danish king bound himself to abide by the decision which Prussia and Austria should adopt in regard to the destiny of the severed Danish provinces. The dissensions between these two great powers, which led to the Austro-Prussian war of 1866, resulted in the triumph of Prussia, and since then the duchies have remained an integral part of that state. Since the war, Denmark, although reduced to the narrow limits of the islands and Jutland, has recovered from its fall, and has greatly prospered, in spite of the spread of socialistic opinions, and the political dissensions that have ranged the government and Landsting, supported by the press of the capital, against the Folkething and majority of the people.



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In 1870 war broke out between Germany and France and an alliance was formed between France and Denmark, with a view to the protection of the latter from German aggression. The result of the war was the downfall of the French empire; this treaty was dissolved, and Denmark felt that her safety lay in a strict neutrality. Yet the resentment of the country towards Germany was by no means allayed, and the general population were indignant that so many leading politicians were anxious to draw closer the lines that bound Germany and Denmark together. This indignation frequently broke out into such violent manifestations that at last it became evident that anything like a close alliance and understanding between the two states seemed impossible.

The 5th article of the treaty made between Austria and Prussia (23 Aug. 1866) had given to Denmark some prospect of recovering the northern districts of Holstein. There arose, however, considerable discussion with Prussia about the realization of this hope, and Prussia seemed reluctant to give any guarantee for the restoration of the territory. So long as the Emperor Napoleon was in power, this article, which he had not only suggested, but had maintained and advocated, the hope of Denmark for the surrender of North Sleswig appeared reasonable. After the catastrophe of Sedan (1870) this hope was forever abandoned. The French republic took no interest in Sleswig, Italy was equally indifferent, England was occupied in other matters and had learned in the Crimea to shun all meddling with other people's quarrels. The rage of the Danes was roused in 1879 on learning that Germany was discussing with Austria the abolition of Article 5 in the treaty, and even the Danish Court, by the marriage of the Princess Thyra, in 1878, with the Duke of Cumberland, whose dislike for the Germans was well known, had shared, by anticipation, in this expression of feeling. This national sentiment of the Danes took almost a warlike character. In the Rigsdag, 1873, legislative measures were proposed for the reorganization of the land and sea forces and the fortification of Copenhagen. The ruling party in the Folkethings strongly advocated an increase in the army and navy, and an improvement in the coast fortifications; this was advisable as a demonstration of power which would be of effect in the case of war between other nations, but would also secure Denmark against the encroachments of Germany. The representatives of rural constituencies or Agrarians, however, together with the Radicals, were opposed to an active policy on the part of Denmark. The Conservatives, with the sympathy of King Christian, were for warlike preparations, by the increased national defences.

In 1874 the Liberal party, under Fonnesbech, succeeded Holstein-Holsteinborg's Conservative cabinet, which had been in power since 1870, but even the Liberals failed to overcome the opposition which the Folkething persisted in showing to the proposed expenditure on the military and naval forces. The king therefore called into office a ministry of a purely bureaucratic character, which

he had counseled Estrup to appoint. Jacob Brønnum Estrup is a remarkable man. Since he took his seat in the Landsting in 1864, when he appeared as leader of the Agrarians, he has shown both power and patriotism in his political career, and has done much for the advancement of Danish constitutionalism. His desire has been to render Denmark's place among the Powers secure and independent, to develop its resources, and especially to secure for his country adequate protection in the carrying trade of the world's commerce. The King had found in him a man ready to carry out his wise designs for the little realm. In 1866 he had been a leading spirit in the revision of the constitutional code of Denmark, and he strongly advocated the view of the Conservatives that the Folkething, or lower house of the Rigsdag, had not, like the English House of Commons, the sole right to make appropriations from the public treasury. The Radicals of the Folkething, however, claimed supremacy in all matters of taxation and finance, and formed the Left in that assembly. On the other hand, the King and Landsting, or upper house, according to the Conservatives, had constitutionally the right of overruling the Folkething. Estrup was on the side of those who would not trust the lower house with the sole control of the exchequer. The government, he maintained, was threefold,—King, Landsting, and Folkething; where any two of them were united against the third, the majority ought to be paramount in deciding the issue. From the time Estrup was appointed Minister of Finance and President of the Council, the clash of parties increased day by day; Estrup again and again brought forth his measures of warlike preparation; again and again were they defeated. In the Folkething the opposition majority increased with every division. In 1876 this party had 74 members as against 27 supporters of the government. It threw out the Budget of Estrup, and the government was compelled to beat a retreat, although the fortification of Copenhagen went forward. This brought about a crisis in political affairs and also led to a new development in the constitution. Estrup stood his ground and was supported by the press as well as by the public opinion of the capital. He maintained that, according to the parliamentary system of Denmark, he had it in his power to propose a provisional finance measure; that such a measure could be carried by the Landsting, the upper house, which controlled the Folkething. The measure was carried with the approval of the King, and the fortifications at Copenhagen were on their way to be completed. In 1880 two measures were passed for the increase of the army and navy. The opposition thereupon began what was known as the "Verdorringspolitik," "The policy of blight," i. e., obstruction. Not only did they oppose the finance measures of the government, but every measure, of whatever kind, proposed by Estrup's party and sanctioned by the Landsting, they threw out. But the King and the ministry remained firm, and were supported by a large majority of the population of the country.



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The fortification of Copenhagen was completed with the assistance of volunteer contributions to the amount of \$253,333.33. The financial prosperity of the country was evident. The appropriation made for land defences amounted to \$10,033,333.33; the department of railways had expended \$17,733,333.33. There was still a large balance in the treasury. The history of Denmark from that time is a history of parliamentary struggle. The Moderates of the Left could not keep pace with the violence of the Radicals, and in 1891 an actual rupture took place. The Moderates desisted altogether from the "policy of blight," or obstruction, and drew nearer and nearer to the Conservatives. The consequence was that the Radicals lost their supremacy in the Rigsdag, and in the elections of April, 1892, forfeited many seats. The opening speech of the prime minister in the Folkething (1892) outlined a policy which was not long in being carried out. The Moderate Lefts supported a measure for land defences; the fortifications projected were quickly finished, and the triumph of the Conservative was complete. This was shortly before the resignation of Estrup in 1894. But the fluctuations of parliamentary life in Denmark was not yet complete. The dispute indeed seemed interminable. The Landsting and the ministry stood on one side, a majority of the Folkething on the other. This majority in the lower house gradually completed the rupture which had been threatened during the debates on land defences, and seemed at last rent asunder permanently into Radicals and Moderates. In August, 1899, M. Hörring became premier. The Radicals had been gathering strength since the retirement of Estrup, and the absence of his firm hand and clear judgment had imperilled the tranquillity of the political voyage in Denmark. In 1900, however, the new Conservatives rallied their strength, and a cabinet was formed by one of their number, M. Sehøsted, who, after a stormy experience, resigned in 1902, when the Radicals won an overwhelming victory at the polls and a Radical administration, under Prof. Deuntzer, came into power. After the elections of September, 1902, the Landsting contained 29 Conservatives, 22 Independent Conservatives, 25 Radicals, and 1 Socialist. The ranks of the Independent Conservatives are largely recruited from the Radicals.

The prosperity of Denmark has greatly advanced since its dismemberment in 1864, and the increase in its trade has been remarkable. In 1898, the merchant steam fleet had an addition of 50,000 tons, in the shape of forty-nine individual ships. These form a part of the great tramp fleet that plies between Europe and America. The trade between Denmark and the United States has especially shown a healthy growth, the imports from the United States to Denmark for 1901 being over \$21,000,000, while the United States imported from that country goods to the value of more than \$2,000,000. This growth of trade between the two countries has been rapid, for the route from Copenhagen to Newport News and Norfolk,

Va., was only opened up in 1898. The six Danish steamers engaged on this route also run to New Orleans and carry American goods to all the principal Baltic ports. The New York route has two large steamers newly built in 1898. The Danes emigrate in considerable numbers to the United States and generally settle in the agricultural districts of the west, notably in Illinois. Recent census returns give the annual Danish immigration as about 4,000. Agriculture has been developed in the peninsula to a remarkable degree during the past few years, and dairy produce manufactured with the aid of steam machinery has shown a proportionate increase. There are about 900 steam dairies in Denmark. The sanitary precautions taken by government in the inspection of cattle are more thorough than anywhere else in the world.

The Danish West Indian possessions have recently been looked upon as likely to become territories of the United States. These comprise St. Croix, the largest of the Virgin Islands; St. Thomas, a smaller island further south, and St. John, to the east of St. Thomas. Their united area is 118 square miles. The proximity of these islands to Porto Rico naturally points to their ultimate annexation and their importance as stations in the trade routes of the Caribbean Sea adds to their desirability as United States possessions. There has been for many years a willingness expressed by Denmark to transfer these islands, and the question was brought up afresh in 1902, when a treaty, providing for the sale of the Danish West Indies to the United States for \$5,000,000, was signed at Washington by President Roosevelt, 14 January, and ratified by the Senate, 17 February. This was considered to have settled the question finally, but 23 April of the same year the Danish Landsting passed a resolution postponing a decision as to the sale, until the electors qualified to send members to the Colonial Council should be consulted. The sale was not to be ratified until these electors should approve the cession. The Folkething went even further than this, and refused to ratify the sale, unless the inhabitants of the islands, who are mostly free negroes engaged in the cultivation of the sugar cane and number 35,156, declared in favor of the transfer by a plebiscite. The matter was thus naturally referred once more to the Landsting, and when the matter came before that body (22 October) their decision was regarded as adverse to the bill. As the Premier reminded the Council, it would be necessary to put out more capital in the islands unless they were sold, and accordingly the West Indian Co., with a capital of \$1,000,000, was formed at Copenhagen three days after the decision of the Landsting. The object of this company is to promote Danish trade with the Danish West Indies. Trade between Denmark and these three islands had been steadily decreasing for some years, and the Danish government in 1902 appointed a commission to proceed to the islands and report on measures for improving their commercial condition.

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*Danish Language and Literature.*—The Danish language has sprung from the southeastern or Danish-Swedish branch of the *dönsk tunga* (or *lingua danica*), which was the common name by which the language of all the Scandinavians was designated in the Middle Ages by the southern races of the Teutonic stock. From the 11th to the 13th century the Danish-Swedish branch of the Old Scandinavian became more and more markedly distinct from the Norwegian-Icelandic branch, through its replacing the old diphthongs with single long vowels, and dropping the initial *h* before *l*, *n*, and *r*; while the latter became characterized by a further modification of the *a* sound, by the loss of *v* before *r*, and by a series of contractions of consonants. In the provincial laws of the 12th and 13th centuries, which (after the Runic monuments) are the earliest specimens of this Danish-Swedish language, there are three dialects—that of Skaane (the southmost province of Sweden) and those of Zealand and Jutland, the first of which is nearest the old language, while the last two have deviated from it by dropping the final consonants from the old inflexional endings and changing their vowels *a*, *i*, *u* to a less distinct *e* or *ø*, retaining, however, the hard mutes *p*, *k*, *t* after vowels, as on the whole is still the case in Swedish and spoken Norwegian. The dialect of Zealand in the 14th and 15th centuries forms the foundation of modern Danish. The original vowels in almost all endings are there replaced by half-vowels and the dental aspirate *þ* by *t* or *d*; *p*, *k*, *t*, when following long vowels, are changed to *b*, *g*, *d*; masculine and feminine are merged in one common gender; nouns have no other case-ending than the possessive *s* for both numbers; verbs cease to indicate person (except in the imperative); and the singular number begins to supersede the plural, as it does everywhere in the spoken language from the 16th century. Danish, like Swedish, retains the suffixed definite article, which is characteristic of the Scandinavian languages. Its form is *-et* in the neuter, *-en* in the common gender, and *-ne* in the plural of both.

The influence of the Hanseatic League and the Oldenburg dynasty (from 1448) brought in a great number of Low-German words, especially relating to navigation and trade; while that of the order of St. Bridget contributed a considerable Swedish element. In the first half of the 16th century the Danish language was chiefly used by religious writers, and the translation of the Bible (1550) is the first important monument of modern Danish. After this period Latin became once more the language of learning and culture, and for a century and a half there was no Danish writer of eminence. The influence of French was predominant in the 17th century, and that of High-German, which had been constant since the Reformation, culminated in the 18th century under the Struensee administration, when it was the language of government and public instruction. The result is, that Danish is indebted to German for fully one third of its vocabulary. It was not till Holberg that the Danish written language began to be enriched from the stores of native expression in the spoken tongue. From the end of the 18th century revived study of Old Scandinavian and the development of a national poetic literature unfolded the language in a hitherto unsuspected richness and fulness, and since that time Danish prose has to a considerable extent worked itself out of

its poverty and dependence. Danish is the softest of the Scandinavian languages, though less euphonious than Swedish. It is the language of the educated class in Norway, where it is considerably augmented from the native dialect, and is spoken with a somewhat harder pronunciation. The best histories of the language are by Petersen (2 vols. Copenhagen, 1829-30) and Molbech (*ib.* 1846); grammars by Rask 2d ed. Lond. (1846), Lökke, Munch, Lyngby, Jessen, and Möbius (Kiel, 1871); and dictionaries by the Danish Academy (Copenhagen, 1793-1881), and Molbech (2d ed. 2 vols. *ib.* 1859), who also produced a 'Dansk-Dialekt-Lexikon' (*ib.* 1841) and a 'Dansk Glossarium' (*ib.* 1853-66) for antiquated words. Ferrall, Repp, and Rosing's 'Danish and English Dictionary,' in 2 parts (4th ed. Copenhagen, 1873), is the best for English students.

*Literature.*—After the Danish dialect had gradually separated itself from the Old Scandinavian as a softer and simpler speech, with a strong infusion of German ingredients, it was little used in writing down to the time of the Reformation. Saxo Grammaticus (that is, "the learned") in the second half of the 12th century wrote in Latin his 'Historia Danica,' the only literary production of mediæval Denmark that retains any interest. The earliest writings in Danish are the church laws of Skaane (1162) and Zealand (1170), and the civil laws of Skaane (1160), Zealand (1170), and Jutland (1241); and after these a number of chronicles, partly in verse, of which the best known is the 'Rimkrönike,' which was the first Danish book printed (in 1495). It is essentially an abridgment of Saxon. The famous Danish ballads called *Kæmpeviser* ("hero-songs"), some of which are said to belong to the latter part of the 11th century, were handed down orally from generation to generation, and were first collected, to the number of 100, by A. S. Vedel in 1591. In 1695 Peder Syv published a new edition with 100 more, and in 1812-14 appeared a selection of 222, edited by Abrahamson, Nyerup, and Rahbek. The most complete collection is in Svend Grundtvig's unfinished 'Gamle Folkeviser' (5 vols. 1853-77). They are about 500 in number, and treat of the adventures of heroes, love, enchantment, spectres, and historical events. Doubtless they were sung to the dance, as is still the case in the Färöe Islands. They must have suffered much by their not being written down till the 16th and 17th centuries.

The Reformation only emancipated Danish culture from Latin to bind it fast to German, which at the death of Frederick I. in 1533 was the language of the upper classes. About that time Christian Pedersen set up a printing-press at Malmö, at which he published a great number of popular books, and finally in 1550 the first complete translation of the Bible. Pedersen (1480-1554) is justly called the father of Danish literature. The hymns and translations of the Psalms by his contemporary Tausen (1494-1561), as also by Kingo (1634-1703), Vormondsen (1491-1551), and Arrebo (1587-1637), and the national history (10 vols. Copenhagen, 1595-1604) of Hvittfeld (1549-1609) were well received; but the Danish language was still banished from higher society till the advent of the Norwegian Holberg (1684-1754), the founder of Danish comedy. He found Denmark on the point of being absorbed in Germany. "The common peo-

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ple," he says, "had no histories but dry lists of dates; no poetry but congratulatory verses; no theology but homilies and funeral sermons; and for plays, nothing but old stories about Adam and Eve." He wrote histories of Denmark, of the Jews, and of the Church; and the irresistible humor of his comedies and satires covered with ridicule the imitations of foreign speech and manners. What Holberg did for Danish prose, another Norwegian, Tullin (1728-65), did for Danish poetry. Equally dissatisfied with the current imitations of the 17th century court poetry of France, and with the poetic reform of Klopstock (at Copenhagen from 1751), Tullin followed the guidance of the English poets Pope, Young, and Thomson, and in this was followed by most of his countrymen who were settled at Copenhagen, while the Danes clung to German models. Ewald (1743-81), an ardent disciple of Klopstock, was Denmark's first great lyric poet and tragic dramatist. His verse shows an unsurpassed mastery of form, and is expressed in pure, clear, and noble language. Wessel (1742-85), by his "tragedy," 'Love without Stockings' (1772), a humorous parody of the Danish imitations of the classical French drama, succeeded in laughing them off the stage. Nordahl Brun (1745-1816), preacher and poet, Claus Frimann (1746-1829), "The Burns of the Norwegians," Claus Fasting (1746-91), Jonas Rein (1760-1821), Jens Zetlitz (1761-1821), and others, formed themselves (1772) into a "Norwegian Society" at Copenhagen, under the leadership of Wessel. It was the literary manifestation of the Norwegian aspiration to separate nationality, which afterward led to the foundation of the university of Christiania in 1811. From the death of Wessel in 1785 to the beginning of the present century the literature became entangled in rationalistic and political polemics, and produced little that is noteworthy. Its chief writers were P. A. Heiberg (1758-1841) and Malte Konrad Brun (1775-1826), both of whom were driven into exile in 1799-1800, the latter afterward famous as a geographer; the critic Rahbek (1760-1830); the dramatists Samsø (1759-96) and Sander (1756-1819); and the lyricist Thaarup (1749-1821).

The poet and humorist Baggesen (1764-1826) forms the link between the 18th century and the early part of the 19th, when Danish literature took an entirely new departure, partly owing to the study of Kant, Fichte, and Schelling, and the influence of Schelling's follower Steffens (1773-1845); partly also to the strict censorship of the press in force from the year 1799. The educated classes turned from their controversies on points of literary criticism and theology to scientific inquiry; and the people, whose national feeling had been aroused by the French Revolution, by the share of Denmark in the Napoleonic wars, and especially by the events of 1801 and 1807, the war with Sweden (1808), and the loss of Norway (1814), welcomed with enthusiasm the rise of a new school, led by the romantic poet Oehlenschläger (1779-1850), who was equally distinguished as a lyrical and dramatic writer, and is still regarded by many as the greatest Danish poet. Contemporary with him were the poets Schack-Staffeldt (1769-1826) and Grundtvig (1783-1872), afterward more eminent as a theologian; Ingemann (1789-1862), long the most popular novelist of Denmark; J. L. Heiberg (1791-1860), director of the royal theatre at

Copenhagen, writer of numerous vaudevilles, and of the still popular national play 'Elves' Hill' (1828); Hauch (1791-1872), dramatist, novelist, and critic; and Blicher (1782-1848), who in his tales of Jutland was the first worker in the field which has since been cultivated in Germany by Jeremias Gotthelf and Berthold Auerbach. Of the other novelists of this period the chief are Brosböll (b. 1820); Fru Gyllembourg-Ehrensvärd (1773-1856), mother of J. L. Heiberg; Saint-Aubain, or 'Karl Bernhard' (1798-1865); and the still more popular Winther (1796-1876), the charming poet of Danish country life Herz (1798-1870), from the time when his 'Ghost Letters' (1830) surprised the public with a poetic revival of the muse of Baggesen, has, now with his lyric poems, now with his tales, now in romantic and national tragedies, now in comedies and light vaudevilles, provided his countrymen with artistic and attractive works. Overskou (1798-1874) is a skilful dramatist, and Hostrup (1818-92) a popular author of comedies. All these writers are surpassed by Hans Christian Andersen (1805-75), whose wonderful stories are known throughout the civilized world. Less popular, but more profound, was the versatile writer Fr. Paludan-Müller (1809-76), who from his play 'Love at Court' (1832) to his great epic poem 'Adam Homo' (1841-48) has wooed all the muses in succession. Here may be mentioned Bergsøe (b. 1835), writer of novels and popular works on scientific subjects; Goldschmidt (1819-87), editor of the influential Democratic journals, 'The Corsair,' 'North and South,' and 'Home and Abroad,' and afterward author of numerous romances; Holst (1811-93), a writer of pleasing lyrics and tales; Kaalund (1818-85), with his two collections of poems 'A Spring' and 'An Autumn'; the erotic and piquant and sometimes frivolous song-writer Aarestrup (1800-56); and Lembeke (b. 1815), the translator of Shakespeare.

A great impulse was given to all branches of science from the beginning of the 19th century. The leading theologians were Grundtvig, the enthusiastic champion of the faith of his fathers against rationalism, and advocate of a union of the Scandinavian kingdoms, but with the Church separated from the state; Mynster (1775-1850), Bishop of Zealand; Clausen (1793-1877), the disciple of Schleiermacher, and theological opponent of Grundtvig; Martensen (1808-84), Bishop of Zealand, and author of standard works on systematic theology and ethics; and Kierkegaard (1813-55), the most original thinker of Denmark. The chief exponents of philosophy were Sibbern (1785-1872), Nielsen (b. 1809), and Bröchner (1820-76); and in natural science the greatest names were those of Oersted (1777-1851), the discoverer of electro-magnetism, the botanist Schouw (1789-1852), the geologist and chemist Forchhammer (1794-1864), and the zoologist and archæologist Steenstrup (b. 1813). Much has been done for the study of Scandinavian antiquity by the 'Sagabibliothek' of Müller (1776-1834), and the researches of Finn Magnusson (1791-1846) in mythology, and of Thomsen (1785-1865) and Worsaae (1821-85) in archæology. The chief 19th-century writers of national history have been Werlauff (1781-1871), Molbech (1783-1857), Allen (1811-77), Schiern (b. 1816), and K. P. Paludan-Müller (1805-82); and of the history of the national literature and language, Petersen (1781-1862). In philology,

Rask (1787-1831) and Madvig (1804-86) have a European fame.

About 1850 the enthusiasm for the national past, which had been excited by Oehlenschläger in Denmark, and by Tegné, Geijer, and others in Sweden, together with the hatred of Germany aroused by the war of 1848-50, rose to a pitch of fanaticism. "The northern force which had controlled the world" was extolled by Ploug and others as "the only means whereby the victory of the Cause of Humanity could be achieved." After Ploug (b. 1813) the chief exponents of this great historic mission of the northern kingdoms were C. K. F. Molbech (1821-88) a euphonious lyricist and skilful dramatist, and translator of Dante; and Erik Bögh (b. 1822), a fertile writer of *feuilletons* and adapter of plays. A cosmopolitan reaction set in about 1870, led by Georg Brandes (b. 1842), who proved in his lectures on literature that Denmark was only a side-chapel in the temple of European thought and art, and that this overstrained "Scandinavianism" was but the northern phase of the reaction from the tendencies of the 18th century, which had been experienced in England, France and Germany many years before. Brandes withdrew to Berlin for some years from the storm of popular opposition. Not only in Denmark, but in Norway and Sweden also, his followers are now the prevailing party. The most conspicuous of these have been Jacobsen (1847-85), the translator and adherent of Darwin, and author of 'Mogens' (1872) and other novels; and (till in 1883 he became a Conservative) Drachmann (b. 1846). Of recent writers, the most noteworthy are Schandorph (b. 1836), who is equally happy in his sketches of the Zealand peasant and the Copenhagen snob; the versatile writer Hermann Bang (b. 1858); and the dramatist Edvard Brandes (b. 1847), brother of Georg Brandes.

Of the three Scandinavian nations, the Danes have shown the greatest aptitude for the imitative arts, and their art is comparatively the most independent. While the painters of Norway have been mostly trained at Düsseldorf, and those of Sweden at Paris, the artists of Denmark have been especially attracted to Rome. The sculptor Thorwaldsen (q.v.) has left a great monument of his genius in the works contained in the Thorwaldsen Museum at Copenhagen. Of later artists may be mentioned the painters Marstrand, Carl Bloch, Exner, Kroyers, Henningsen, and Otto Bache. Of music, the chief composers in the 19th century have been Hartmann, Gade, and Heise.

Consult: Nyerup and Rahbek, 'Den danske Digtekunsts Historie', 4 vols. (1800-8), and 'Udsigt over den danske Digtekunst under Frederik V. og Christian VII.' (1819-28); Nyerup and J. E. Kraft, 'Almindeligt Litteraturlæxikon for Danmark, Norge og Island' (Copenhagen, 1818-20); Peterson, 'Den danske Litteraturs Historie', 6 vols. (1853-64); Overskou, 'Den danske Skueplads i dens Historie' (1859-74); G. Brandes, 'Ludwig Holberg og hans Tid' (1884); the general treatises in Danish by Thortsen (1814; 6th ed. 1866), Heiberg (1831), Molbech (1839), Strom (1871), Erikson (Christiania, 1878), Winkel-Horn (1880), and Hansen (1884 et seq.); and in German by Strodtmann (1873), Wollheim de Fonseca (1874-77), and Winkel-Horn (1880); Gosse 'Studies in the Literature of Northern Europe' (1879); Ander-

son, 'History of the Scandinavian North' and 'Norse Mythology'.

**Denne-Baron, Pierre Jacques René**, pē-ār zhāk rê-nā dān bā-rôn, French poet and essayist: b. Paris 6 Sept. 1780; d. there 5 June 1854. He had much learning and a faultless taste; 'Hero and Leander' (1806); and 'Poetic Flowers' (1825) being delightful though not great, while his 'Dictionary of Conversation' is widely known.

**Den'ner, Balthazar**, German portrait painter: b. Altona 15 Nov. 1685; d. Rostock 14 April 1749. He was painter to several courts, executing portraits of princes and dignitaries, and was noted for his extraordinary minuteness of finish. Among his works are: 'Head of an Old Woman'; for which Charles VI. paid 4,700 florins; and 'Head of an Old Man,' both in the Vienna Museum; and many canvases in other famous galleries.

**Dennery, Adolphe Phillipe**. See ENNERY, ADOLPHE PHILLIPE DE.

**Dennewitz, dēn'nē-vīts**, Germany, village in the province of Brandenburg, Prussia, famous for the battle between the French and Prussians, 6 Sept. 1813, the former commanded by Ney (under whom were Oudinot, Bertrand, Reynier, and Arrighi), the latter by Tauenzien and Bülow. Forty thousand Prussians maintained their ground for several hours against 80,000 French; and on the arrival of the Russian and Swedish battalions victory declared in favor of the allies, who, after the Russians and Swedes came up, were far superior in numbers. The French were defeated, and fled in disorder.

**Dennie, Joseph**, American journalist: b. Boston 30 Aug. 1768; d. Philadelphia 7 Jan. 1812. He published 'The Farrago' (1795), essays on life and literature. From 1796 to 1798 he edited with great success the 'Farmer's Weekly Museum' at Walpole, N. H. In this appeared his essays signed 'The Lay Preacher,' whose droll and easy style made him popular. In Philadelphia (1801), assisted by Asbury Dickens, he founded the 'Portfolio,' which he edited till his death under the pen-name of 'Oliver Old-School.' Two collections of his writings have been published: 'The Lay Preacher, or Short Sermons for Idle Readers' (1796); and 'The Lay Preacher' (1817).

**Dennis, John**, English dramatist and critic: b. London 1657; d. 6 Jan. 1734. In 1697 he produced a comedy entitled 'Plot and No Plot,' which was followed by several dramatic pieces and poems of little value. He also became a political writer for the Whig party. The irritability of his disposition, heightened probably by the unprosperous state of his finances, involved him in perpetual broils, and made him a sort of standing jest with the wits of his time. He wrote some severe strictures on Addison's 'Cato' and Pope's 'Rape of the Lock.' Pope in return gave him a place in the 'Dunciad,' and in conjunction with Swift produced a sarcastic tract entitled 'A Narrative of the Deplorable Frenzy of Mr. John Dennis.' In his old age his necessities were relieved by a benefit at the Haymarket Theatre, to which his former antagonist, Pope, contributed a prologue.

**Dennis, Robert**, English journalist: b. Bodmin, Cornwall, 5 Jan. 1855. He was educated at Leipsic, was for a time reporter and

## DENNISON — DENSITY

assistant editor on the *Mail* and *Glasgow News*, and then, removing to London, served on the staff of various London papers, and has been news editor of the London *Daily Express* from its foundation. He has published: 'Industrial Ireland' (1887); 'History of the Baronetage' (1887); 'The New Politics' (1898); 'A Romance of Tottenham' (1899).

**Dennison, William**, American statesman: b. Cincinnati, Ohio, 23 Nov. 1815; d. Columbus, Ohio, 15 June 1882. He was graduated at Miami in 1835 and became a lawyer, being elected to the Ohio legislature in 1848. He became governor of Ohio in 1860, and rendered invaluable aid to the Union cause throughout the Civil War. President Lincoln appointed him postmaster-general in 1864, an office he retained under President Johnson, resigning in 1866. Dennison College owes much to his liberality.

**Denon, Dominique Vivant, dō-mē-něk vē-vān dē-nōn**, BARON DE, French artist, diplomatist, and author: b. Châlons-sur-Saône 4 Feb. 1747; d. Paris 27 April 1825. He was attached to embassies at St. Petersburg, Switzerland, and Naples, successively. Becoming acquainted with Bonaparte, he accompanied the general in his campaigns to Italy and Egypt, and Desaix to Upper Egypt. The work which was the result of this journey, 'Voyage dans la Basse et la Haute Egypte,' was issued in 1802. When he returned to Paris with Bonaparte he was appointed inspector-general of the museums and all the works of art executed in honor of the French successes — monuments, coins, the erection of the triumphal pillar in the Place de Vendôme, etc. He accompanied Napoleon in all his campaigns, and employed himself in drawing and in selecting those masterpieces in the conquered countries, which were taken to Paris as trophies. After the abdication of the emperor he retained his office, but was deprived of it in 1815, in consequence of having joined Napoleon on his return from Elba. He retained, however, his place in the Institute. From that time he lived retired, and the preparation of engravings and lithographs of his splendid collection of works of art formed the occupation of his last years. In 1826 appeared at Paris the 'Description des Objets d'Art Composant le Cabinet de feu M. le Bar. V. Denon.'

**Dens, Petrus**, author of a manual of Catholic theology: b. Boom, Belgium 1690; d. Mechlin 15 Feb. 1775. He is noteworthy only as author of a manual text-book of Catholic theology, 'Theologia Moralis et Dogmatica' (Moral and Dogmatic Theology). This work, which, it seems, was used as a text-book in the ecclesiastical college of Maynooth in Ireland, happening to come under notice of some zealous opponents of the Roman Catholic Church, was translated (in whole or in certain parts) and published at Dublin in 1832 in the interest of anti-popery. The so-called incriminating passages in the work do not differ essentially from corresponding portions of other treatises on the same subjects used in Catholic schools of theology. The author of the treatise was a professor in the diocesan seminary of Mechlin and during 40 years was president of the institution. He was also honored with several offices of importance in the diocese of Mechlin — Canon Penitentiary, synodical examiner, archpriest of the

Metropolitan Cathedral of Belgium, and other offices.

**Densim'eter**, an instrument invented by Colonel Mallet of the French army, and M. Bianchi, for ascertaining the specific gravity of gunpowder. It consists of a glass globe having a tube which communicates with a quantity of mercury in an open vessel. The globe is joined at top to a graduated glass tube, which may, by means of a flexible tube, be connected with an air-pump. A diaphragm of chamois skin fits over the lower, and one of wire-cloth over the upper orifice of the globe, and the tubes above and below those orifices are provided with stop-cocks. For ascertaining the density of the gunpowder, the air is exhausted from the globe by means of the air-pump, until the mercury rises to a certain mark on the graduated tube when the globe is detached from its support and weighed. It is then emptied and cleaned, and a given weight of gunpowder introduced, when it is again attached to the tubes and the air exhausted as before, filling with mercury all the space in the globe not occupied by the powder, up to the mark before indicated. The stop-cocks are now closed, and the globe once more detached and weighed. The absolute specific gravity of the powder is obtained by multiplying the weight of the powder contained in the globe by the known specific gravity of mercury, and dividing the product by the product resulting from multiplying the difference between the weight of the globe when filled with mercury alone, and its weight when filled with mercury and powder, by the weight of the powder employed in the experiment.

**Density**, a term denoting the quantity of matter per unit of volume in a body. A cubic inch of lead is considered to contain a greater quantity of matter than a cubic inch of wood, and lead is thus said to be more dense than wood. Mass or quantity of matter is measured by its inertia, according to Newton's celebrated 'laws of motion'; or, since Newton has shown experimentally that gravity and inertia are proportional, the mass of a body is measured by its weight. A comparison of the weights of equal bulks of various bodies results therefore in a comparison of their densities. In order to test the densities of various bodies conveniently, a standard substance is fixed on, and the densities of other substances are reckoned by comparison with this. For all liquids and solids, water at a fixed temperature is taken as the standard; and for all gases the standard is common air at a fixed temperature and barometric pressure. There is however some variation in the temperature fixed on, in the first case, and in both the temperature and pressure fixed on in the second. Thus in England the standard temperature for water used to be 60° F. and sometimes 62° F. The latter temperature is mentioned in the legal definition of the imperial gallon. Again, in the case of gases the standard temperature was 60° F. or 62° F., and the standard pressure 30 inches of mercury in the latitude of London.

The metric system on the other hand, makes use of the temperature 4.1° C. (the temperature of the maximum density of water) as the standard for water, and of the pressure 76 centimeters of mercury in latitude 45° as the standard barometric pressure. For gases the temperature



## DENSLOW—DENTATUS

o° C. (the melting point of ice) is always employed as the standard. See GRAVITY, SPECIFIC.

*Density of the Earth.*—The determination of the density of the earth as compared with that of water or any other known body, is a subject which has excited considerable interest among modern mathematicians; and nothing can, at first sight, seem more beyond the reach of human science than the due solution of this problem; yet it has been solved and on such principles that, if it be not exactly correct, it is probably an extremely near approximation. The first idea of determining the density of the earth was suggested by M. Bouguer, in consequence of the attraction of Chimborazo, which affected his plumb-line while he was engaged with Condamine in measuring a degree of the meridian near Quito, Peru. This led to the experiments on the Schehallien Mountain, in Scotland, which were carried on under the direction of Dr. Maskelyne, and afterward submitted to calculation by Dr. Hutton, who determined the density of the earth to be to that of water as  $4\frac{1}{2}$  to 1. But in consequence of the specific gravity of the mountain being assumed rather less than it ought to have been, the above result is less than the true density, as has since been shown by Dr. Hutton and Professor Playfair, the former of whom makes it, in his corrected paper, as 99 to 20 or nearly as 5 to 1. The same problem was attempted on similar principles, but in a totally different manner by Henry Cavendish who found the density of the earth to be to that of water as 5.48 to 1. Taking a mean of all these we have the density of the earth to that of water as 5.24 to 1. Two calculations made on quite different principles by two physicists in 1899 showed the surprisingly similar results of 5.5270 and 5.5273.

**Denslow, William Wallace**, American illustrator: b. Philadelphia 5 May 1856. He studied art at Cooper Institute and at the National Academy of Design, New York. He has been a prolific illustrator since 1872, at first being a traveling illustrator for the leading American newspapers. Among his works are the pictures: 'What's the Use?' 'Victory,' and 'The Heathen Chinese.'

**Dent, Frederick Tracy**, American soldier: b. White Haven, Mo., 17 Dec. 1820; d. Denver, Col., 24 Dec. 1892. He was graduated from the United States Military Academy at West Point in 1843, and served in the Mexican war, being engaged in the siege of Vera Cruz, and the battles of Churubusco and Molino del Rey. He took part in the Yakima expedition (1856), in the Spokane expedition, and in the Snake River expedition (1860). During the Civil War he commanded a regiment in the Army of the Potomac in 1863; was stationed in New York in September 1863, where riots were feared, and was Grant's aide-de-camp throughout the Richmond campaign. He was secretary to President Grant during his first administration. He retired from active service in 1881, with the rank of brigadier-general in the regular army.

**Dental Formula.** See TEETH.

**Dental Schools.** The Baltimore College of Dental Surgery, established 1839, was the first institution of the kind in the world. Other schools in the United States are: Ohio College of Dental Surgery (1845); Pennsylvania Col-

lege of Dental Surgery (1856); Philadelphia Dental College (1863); New York College of Dentistry (1865); and dental departments at Harvard since 1867, University of Michigan since 1875, and University of Pennsylvania since 1878.

**Dental Societies.** In 1840 the American Society of Dental Surgeons, the pioneer of the associations to which dentistry owes so much of its progress, was organized in New York. The National Association of Dental Faculties, organized in 1884, has done much to strengthen courses of study in dental schools. At the time of its organization only those schools were admitted which had proper facilities for instruction and a corps of competent teachers. From time to time standards have been raised by rules governing attendance, instruction, and graduation. There are at present 47 schools in the association, all of which require three full courses of dental lectures. The National Association of Dental Examiners was organized in 1883 to secure higher and more uniform standards for admission to dental practice.

**Dentalium**, a genus of mollusks of the class *Scaphopoda*, the shell of which consists of a tubular arcuated cone open at both ends, and resembling the tusk of an elephant in miniature. They bury themselves in the sand, and capture their food, which mainly consists of foraminifers, by means of their tentacles. *Dentalium* is one of the three genera constituting the small class *Scaphopoda*. There are many species, known by the common name of tooth-shells. *D. elephantinum* occurs off the British coasts.

**Dentaria**, pepper-root, a genus of plants of the natural order *Cruciferae*. There are about 15 species, natives of temperate countries, of which 11 are found in America. They are ornamental herbs, with creeping singularly toothed root-stocks, from which they receive the names of pepper-root and toothwort. The stem-leaves are opposite or in whorls of three, and the flowers are white or pink. The American species extend from Nova Scotia to Florida and west to Minnesota and Louisiana. The best-known is the pepper-root, crinkle-root, or toothwort (*D. laciniata*). The common names refer to the pungent and tooth-like divisions of the root, which is, in some localities, ground and used like horse-radish.

**Dentatus, Manius, or Marcus, Curius**, Roman statesman, flourished in the first half of the 3d century B.C. His first office was tribune of the people, in which he distinguished himself by his opposition to Appius Claudius Cæcus, who, in defiance of law, refused to receive any votes for plebeian candidates. In 290 B.C. he was consul with P. Cornelius Rufinus, and by his decisive victories over the Samnites terminated a war which had lasted for 49 years. In 275 B.C. he was again consul, and near Beneventum defeated King Pyrrhus. The triumph which followed was one of the most magnificent which had ever been witnessed, and was remarkable for the presence of four elephants, which were then seen for the first time in the streets of Rome. In 274 B.C. he was a third time consul, and after terminating the war with the Lucanians, Samnites, and Brutians, retired to his Sabine farm and spent the remainder of his life in cultivating it.



## DENTEX — DENTISTRY

**Den'tex**, a genus of acanthopterous fishes near perches. One species (*D. vulgaris*), the *Dentex* of the ancient Romans, abounds in the Mediterranean, and has occasionally been taken on the southern shores of Great Britain. It is voracious, and has large, sharp teeth. It is sometimes seen three feet in length, and 20 to 30 pounds in weight. Great numbers are taken in the mouths of rivers in Dalmatia and the Levant, where they are cut in pieces, and packed in barrels with vinegar and spices, just as the ancients used to treat them.

**Den'tifrice** (Lat. *dentifricium*, a tooth-powder, *dens*, tooth, *fricare*, to rub), any preparation, liquid or powder, for the purpose of cleaning the teeth. Chalk, precipitated, is generally the base of most of the dentifrices on the market. For detergents, charcoal, cuttlefish-bone or pumice are sometimes incorporated with the milder principle. Bleaching salts and acids find their way in many market preparations, constituting a grave danger to the tooth structure. A few drops of any of the standard antiseptics added to water will often prove an efficient cleanser aided by the friction of the brush.

**Den'tils**, in architecture, the little cubes or small squarish blocks resembling teeth, into which the square member in the bed-molding of an Ionic Corinthian, composite and occasionally a Roman Doric cornice is divided. Their breadth should be half their height, and the metoche (interval) between them two thirds of their breadth.

**Dentin**, or **Dentine**, den'tin, the bone-like structure constituting the body of a tooth, which in the crown portion is covered by enamel and in the root portion by the *crusta petrosa* or cementum. See **TEETH**.

**Dentistry** is a special department of the science and art of healing; embracing a knowledge of the structure, physiology, and pathology, and the therapeutic, surgical, and mechanical treatment of the tissues of the mouth and its contained organs, also a knowledge of the materials used and their manipulation in the restoration of the dental and oral structures.

Operations upon the teeth for relief from distress caused by diseases and accidents to which they are subject were doubtless performed concurrently with man's first efforts to relieve his other bodily ills. Dentistry as a distinct vocation is first alluded to in the writings of Herodotus (500 B.C.), but evidences of a much earlier practice are furnished by Egyptian and Hindu records and by the teeth in the crania of some of the earlier aboriginal races. The early Greeks and Romans were evidently familiar to some degree with dental art, for in the celebrated laws of the 'Twelve Tables' (450 B.C.) we find reference thereto in the Tenth Table, as follows: *Neve aurum addito: cui auro dentes juncti escunt, ast in cum illo sepeliet, uretve se fraude esto.* "If anyone's teeth have been bound together with gold it shall not be unlawful to bury him with it." It is probable that the Romans derived their knowledge of dental art from the Etruscans, who in turn derived theirs from the Egyptians, the fountain-head of the arts and sciences. Of the growth of dental art from the time of Hippocrates until the Christian Era but little is recorded, and even thereafter, until the

17th century, such advances as were made in a knowledge of the teeth were largely in relation to their structure and functions, but the recorded observations were much influenced by the superstition and ignorance of the time, and are consequently of but little value. The observations of Antoni van Leeuwenhoek of Delft, Holland, on the anatomy of the teeth, published in 1678, contained an account of his discovery of the tubular structure of the dentin—a discovery made possible by the aid of a crude form of microscope which the author had invented. Up to this period operations upon the teeth were largely practised by surgeons and not infrequently by barbers, and were limited principally to extraction and the treatment of toothache and abscesses or inflammatory disorders of the soft tissues surrounding the teeth. The restoration of teeth by mechanical means and the filling of cavities caused by decay of their structure called for a type of skill which the training of the surgeon and physician did not furnish, hence there was developed from the crafts of the artisan, the goldsmith and the workers in precious metals, the dental mechanic, whose skill enabled him to devise and fashion the substitutes for lost dental organs, an art which later, as a result of systematic study and organized professional training, has developed a high degree of perfection.

The development of modern dentistry as a professional calling has had a distinctly double origin: first, as an outgrowth of medicine and surgery, certain practitioners of these arts in the earlier days devoting themselves to dental practice and adding to their medical qualifications such technical and manipulative skill as enabled them to meet the public demand for restorative operations upon the teeth; second, the artisan or mechanic dentist who acquired so much of medical and surgical knowledge as enabled him to treat with some measure of success the dental diseases with which his calling confronted him. In England at the beginning of the 19th century the best practitioners of dentistry were medically educated men, of whom Joseph Fox, lecturer on diseases of the teeth at Guy's Hospital, London, may be taken as the type. Both Fox and his successor, Thomas Bell, published works on diseases of the teeth which for their time were standards. The works of other British writers on the same subject, notably those of Koecker, Jobson, Waite, and Alexander Nasmyth, all made their appearance in the first half of the 19th century. The works of these English practitioners and teachers were characteristic of the medically and surgically educated practitioners in that the anatomical, pathological, and therapeutic departments of dental science and practice were strongly emphasized by them, while the manipulative phase and restorative department of dental art were given a minimal recognition.

Of the earliest origin of the art of mechanically restoring lost dental structures the records are obscure. Jaws in which natural teeth or carved imitations of them were inserted and retained by means of gold bands affixed to adjoining sound teeth have been found in early Etruscan tombs—specimens of this character being preserved in the museum of Pope Julius in Rome and elsewhere. Specimens of similar restorations are also recorded as having been found in the mouths of Egyptian mummies. No rec-

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ord, however, of a systematic presentation of this department of dental art is known to have been published until the work of Pierre Fauchard made its appearance in France (1728). This treatise upon the art of dentistry was most complete for that period, and so great was its originality that its author has with much justice been called the "father of modern dentistry." Fauchard was born in Brittany (1680) and died in Paris (1761). In the preface to his book he makes the following interesting statement regarding the then existing status of dentistry: "The most celebrated surgeons having abandoned this branch of surgery, or at least having but little cultivated it, the negligence has been the cause of its being embraced by those who, without theory and without experience, practise it without principles or methods. It is only recently that in the city of Paris the eyes have been opened to this abuse, and an easy examination is required of those who devote themselves to the treatment of these diseases, after which they are granted the title of Experts upon the Teeth, although several among them are only provided with a knowledge below mediocre." As it was provided that the examination referred to should be conducted by "men learned in all branches of medical science" who should decide upon the merits of the applicant, we have in this measure the first recorded attempt at the statutory regulation of dental practice which is now a generally exercised safeguard to the public health in all nations. The work of Fauchard gave an impulse to the practice of dental art and tended to specialize it as a distinct calling; it was the art of Fauchard which was implanted upon American soil by the French dentist, Joseph Lemaire, a surgeon attached to the forces of Count Rochambeau, whose army was quartered with the Colonial troops near Providence, R. I., during the winter of 1781-2. Although Lemaire had been preceded in 1756 by one Robert Woofendale, a student of Thomas Berdmore, dentist to His Majesty King George III., and probably by one or two others of whom the records are obscure, the importance of Lemaire's visitation attaches to the fact that he took occasion to instruct in his art Josiah Flagg, a young man holding a major's commission in the Colonial army, and he thus educated the first dentist native to this country. Another who profited by Lemaire's instruction along with Josiah Flagg was James Gardette who arrived with the French fleet in the capacity of naval surgeon, but who through his interest in the work of Lemaire turned his attention to dentistry and after the close of the war went to Boston, thence to New York in 1783, and finally in the autumn of 1784 settled in Philadelphia, where he practised his profession as dentist until 1829, when he returned to France and died in Bordeaux (1831). The career of Gardette as a dental practitioner was remarkable not only from a financial standpoint, but by reason of the intelligence which he exercised in his calling and the ingenuity and skill which characterized his work. He added many useful improvements to dental art and attained much prominence as a skilled and ethical professional man.

Early in the 19th century several dentists who did much to elevate dental practice and place it upon a professional plane arrived in America from Europe. Edward Hudson, a na-

tive of Ireland, and Leonard Koecker, of Germany, both of whom practised in Philadelphia, were noted for their excellence as practitioners and their high professional standing. These early pioneers of American dentistry were practitioners *sui generis*. Their means of education and professional training were limited to what they could obtain from preceptors and the scanty literature of the time, but what they lacked in educational facilities was more than compensated by their natural ability and enthusiasm, and so excellent were the standards which they raised that much that is best in modern dentistry is to be justly credited to their almost unaided achievement and professional example. The success of the early practitioners and the increasing demand for dental service coincident with the growing population, brought about a corresponding increase in the number of those who offered their services to the community as dentists. There being no legal restrictions upon practice, anyone might advertise himself as a dentist regardless of his qualifications for the practice of that specialty, hence, tempted by the emoluments and position which dentistry seemed to offer, many incompetents engaged therein and charlatanism was rife. The only means of obtaining a practical knowledge of the art of dentistry was through the instruction of a preceptor who had similarly acquired it, hence the instruction of apprentices became a lucrative business, as large fees were charged for initiating the novice into the art and mystery of dental practice. The knowledge thus gained at considerable cost and having a commercial value was jealously guarded, and with but few exceptions professional intercourse among practitioners was an unknown feature. This deplorable condition of affairs becoming intolerable to those dentists of more liberal tendencies, an attempt was successfully made in New York in 1787 to organize a local association of dentists, and in 1840 in the same city a national association, the American Society of Dental Surgeons, was organized, mainly through the efforts of Dr. Horace H. Hayden of Baltimore, "to advance the science by free communication and interchange of sentiments."

The year previous to that which saw the creation of the American Society of Dental Surgeons the first dental journal in the world had been established through the instrumentality of Dr. Chapin A. Harris, who had enlisted a number of the more liberal and enthusiastic of his colleagues in the enterprise, and in 1840 the first college in the world for the systematic education of dentists, the Baltimore College of Dental Surgery, opened its first course of lectures and laboratory instruction in the science and art of dentistry. The charter for the institution, which is still in successful operation, was obtained from the legislature of Maryland by Drs. Harris, Hayden, and others. In the years 1839-40 there were thus established the three essential factors of professional growth in dentistry—the college, the association, and the journal. The establishment of these means of systematic dental education upon an independent basis with a separate organization for associated work among dental practitioners led to the growth of dentistry as a professional calling, distinct from medicine, although it is essentially a department of the science and art of

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healing by virtue of the fact that it deals with the diseases of a most important part of the human organism, which have intimate vital relationships with the entire body, and for its successful practice demands as broad a knowledge of the fundamental medical sciences as that required by the practitioner of any other medical specialty.

The distinguishing factor of dental training, and one which is not required to the same degree in any other department of the healing art, is the manual skill and mechanical training needed for the successful practice of the prosthetic or restorative operations which the dentist is constantly called upon to perform. It was the lack of facilities in medical schools for obtaining the necessary training in the mechanical procedures of dental art that led to the establishment of the first dental college and placed dental education upon a basis independent of general medical education. The increase in knowledge of the diseases of the mouth and its contained organs and the growing recognition of the vital relationships of the oral tissues to the body as a whole, have gradually compelled the broadening of the dental educational curriculum until at present all of the fundamental medical sciences are included in the *curricula* of the best dental colleges, and upon this scientific foundation is erected the superstructure of technical education and manual training necessary to the art of the dentist.

The development of dentistry in America has been phenomenal, especially in all that pertains to its art side. The incorporation of the systematic teaching of mechanical dentistry in the college course instead of depending upon the uncertain educational results of the apprenticeship system has had greatly to do with creating a body of American practitioners skilled in their art. It is in fact for his skill as an operative dentist that the American practitioner has been mainly distinguished, while his contributions to the scientific basis of dentistry have been on the whole less voluminous than those of European practitioners, especially in the domain of original scientific research. The art of replacing lost portions of tooth crowns by gold fillings has had its greatest development in America, indeed as we know the operation to-day it may be said to have originated there. As originally practised the ideal gold filling was one which simply acted as a stopper inserted in a cavity produced by decay, for the purpose of excluding moisture and furnishing a surface sufficiently resistant to withstand the wear and tear of mastication. The filling was finished on a level with the cavity margins and no attempt was made to restore the lost contour of the tooth in imitation of its natural configuration. When, however, the discovery of the cohesive property of annealed gold foil was made and promulgated by Dr. Robert Arthur, of Baltimore, in 1855, the whole method of filling teeth with gold was revolutionized and complete artistic restoration of the normal configuration of the tooth by building with gold foil became the accepted ideal of practice. In connection with the general use of cohesive gold as a filling material certain ingenious and important devices came into existence as adjuncts to the operation of tooth-filling, having their origin in the necessities of the case. These were the dental engine, the mallet, and the rubber coffer-dam.

The operation of preparing the cavity for the reception of the gold involves the removal of decayed portions and frail margins, and giving to the cavity a retentive shape, so that the filling when inserted shall be solidly and immovably held in place. The early methods of cavity preparation were laboriously performed by small chisels and cutting instruments manipulated exclusively by the hand. Hand instruments were also exclusively used for the insertion and condensation of the gold foil in building the filling and subsequently giving it the required form and surface finish. The introduction of the dental engine run by foot-power, or as in its more recent modifications by electric motor, has not only greatly facilitated the operation of tooth-filling but has made possible more accurate and perfect results. So manifold have been the improvements made in the dental engine and its equipment of accessory appliances that it may, if the operator so desire, be used for every step of the operation from cavity preparation to the finished filling. As the cohesive property of gold, upon which its value in restoring the form of the tooth depends, is at once destroyed by contact with moisture, great difficulty was formerly experienced during large filling operations in excluding the gold from contact with saliva; napkins, bibulous paper and various mechanical devices were used for the purpose, but were often insufficient to prevent the destruction of a filling during the progress of its insertion. The device known as the rubber dam, introduced by Dr. S. C. Barnum of New York, about 1865, solved the problem of effectually excluding moisture from the teeth undergoing the filling operation and made possible more extensive and thorough restorations than had previously been attempted. The discovery of the usefulness of the cohesive property of gold in filling operations soon brought into requisition other means than simple hand pressure for condensing the gold foil into a solid homogeneous mass. It was soon found that greater solidity could be obtained by the percussive force of a mallet applied to the gold through the plugging instrument, so that the use of the mallet became general for the purpose, largely through the persistent advocacy of Dr. W. H. Atkinson of New York. The earlier forms of condensing mallets were simply hand mallets with heads made of various materials and different weights to attain desired variations in the impact and quality of the blow delivered upon the condensing instrument. Later, automatic mallets combining a plugging instrument and mallet were introduced. In these instruments the blow was produced by a hammer propelled by the release of a spring compressed by pressure, the malleting mechanism being contained in a casing connected with the plugging point which was applied to the surface of the filling upon which the impact of the blow was ultimately expended. In 1867, Dr. W. G. A. Bonwill, of Philadelphia, introduced his electromagnetic mallet, an instrument which involved the principle of the Morse telegraphic recorder so modified that the armature of the electro-magnet was effectively utilized as a mallet acting upon the free end of the gold-plugging instrument. With the automatic interrupter of the current afterward added to it the Bonwill instrument contributed greatly to the improvement of gold-filling operations both in the solid-

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ity of the gold, its more accurate adaptation to the walls of the cavity, and in lessening the fatigue and discomfort of both patient and operator incident to the operation. The blows delivered by the electro-magnetic mallet while light are extremely rapid, an advantage which its inventor sought to realize in a later device, to be used in connection with the dental engine, known as the Bonwill engine mallet, an instrument of high efficiency and the parent device of many subsequent modifications.

The extensive use of gold as a filling material and the perfection to which the technique of its use for that purpose has been developed, especially in America, has recently brought about a reactive tendency against the display of elaborate operations of gold, especially in conspicuous positions in the front teeth, æsthetic considerations stimulating the search for some substitute more in harmony with the texture and color of human teeth. Recently through the invention of an improved technique by Dr. C. H. Land of Detroit, Mich., and the further investigations of Dr. N. S. Jenkins, an American dentist resident in Dresden, Germany, the use of porcelain as a restorative material has become practically possible and bids fair to supplant gold as a filling, at least in conspicuous situations. The durability of porcelain restorations as compared with gold fillings remains to be tested by time and experience, but the immediate result is in all respects in favor of porcelain, especially in the matter of appearance, which so harmonizes with the teeth structure in color and texture as to be invisible when the operation is correctly performed. The filling of cavities is also extensively done with plastic materials that have the property of becoming hard in the course of time after having been inserted in a soft state. This class of materials includes the amalgams and cements, also gutta-percha. Certain of these materials, the cements for example, serve only a temporary purpose, and their usefulness is therefore of limited duration. The amalgams, however, while unsightly in appearance, are extremely useful; being quite durable and capable of insertion without great difficulty, they can be used in cases of great loss of tooth structure, thus restoring many cases that could not otherwise be as successfully treated, and with less cost than gold filling.

Following the researches of Koch in bacterial pathology, the role played by micro-organisms in the causation of dental diseases became the subject of study by numerous investigators, notably Prof. W. D. Miller, an American dentist resident in Berlin, through whose researches the cause of tooth decay was explained. Similarly the causal relation of disease-producing micro-organisms to disorders of the dental pulp and the tissues surrounding the roots of teeth has been clearly made out, with the result that operations upon the pulp chambers and root canals of teeth in which the pulp has been devitalized by disease or design are now among the recognized conservative operations of dentistry. This advance in the treatment of pulpless teeth has made possible the permanent saving of multitudes of teeth in a condition of comfort and functional usefulness which were previously inevitably sacrificed or lost. Later investigations in the domain of dental and oral pathology are throwing light upon the causes and improving the modes of treatment

of those diseases of the retaining tissues of the teeth which when unchecked result in their early loss by destruction of their attachment to the gums and alveolar sockets.

Dental art has in the development of its operative technique compassed the problem of defective tooth restoration, and has made possible the restoration not only of any portion of a single tooth, but of a whole tooth or any number of missing teeth. Where roots of teeth remain and are not hopelessly diseased or fractured, they form the foundations for that class of restoration known as crown- and bridge-work, the desirability and efficiency of which is directly proportioned to the skill and judgment expended upon its execution.

The grafting of artificial crowns of porcelain upon healthy natural roots is accomplished in a large variety of ways, the attachment being by metallic dowels cemented into the properly enlarged pulp canal of the root, this being in most cases reinforced by means of a gold collar or ferrule connected with the porcelain crown, closely encircling the periphery of the root at and slightly under the gum margin. Perfect adaptation of the crown and root end is obtained by correctly shaping the exposed portion of the root and then fitting to it a thin gold base-plate, to which is adapted the dowel and ferrule, after which the properly fitted porcelain crown is attached to this foundation by gold solder and a backing plate of gold connecting with the platinum pins of the crown. In certain cases hollow crowns made entirely of gold plate shaped to the contour of the original natural crown are used upon the roots of the grinding teeth instead of porcelain crowns, as they possess the advantage of superior durability. Aggregations of crowns permanently united upon their contiguous surfaces and supporting crowns in spaces where teeth have been extracted constitute so-called bridge work. No restorative operation in dentistry requires more judgment and skill, nor has any dental procedure been more abused in its performance than bridge work. Where the operation is intelligently and skilfully done, it constitutes the most satisfactory result both as to comfort, utility, and appearance, that prosthetic dentistry has yet attained; otherwise it defeats the very object for which only it should be undertaken, namely, the restoration of the denture to full functional usefulness and æsthetic appearance.

The department of dentistry technically known as mechanical or prosthetic dentistry comprises all those operations and the laboratory manipulation of the materials involved in the construction of substitutes for lost dental organs and parts of the oral tissues. Where lost teeth are to be replaced by means other than those described as crown and bridge work, it is done by mounting the porcelain crowns upon a base-plate adapted to the surface of the alveolar ridge and in the upper jaw usually to the surface of the palatal vault as well. An impression of the alveolar arch is taken in an impression tray containing a plastic material, which will subsequently harden, usually plaster of Paris or a modeling compound consisting of gum kauri, stearin, and talc; beeswax or beeswax and gutta-percha have been used, but are now practically abandoned for this purpose. Into the matrix formed by the impression a batter of plaster of Paris is poured, which after it has

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hardened forms the cast upon which the base-plate to support the artificial teeth in the mouth is constructed. The base-plate may be of vulcanite or of metal, and in the former case the porcelain teeth are adjusted to the cast by means of wax, and a wax plate is constructed which is the counterpart of the projected finished vulcanite plate. When the arrangement of the teeth to the wax trial plate has been found to be satisfactory by actual trial in the mouth of the patient, it is returned to the cast and the whole embedded in plaster of Paris contained in a sectional iron vulcanizing flask, similar in construction to the molding-flask of the brass or iron founder. The upper and lower sections of the flask are separated after the investing plaster of Paris has fully hardened, and the wax is completely removed by a stream of boiling water, leaving a facsimile matrix in the plaster, which is then packed full of vulcanizable caoutchouc; the flask is then closed, and after being firmly bolted together is subjected to the action of the heat from superheated steam for about an hour at 320° F. in a vulcanizer. The case is allowed to cool, and when removed from the matrix the now thoroughly hardened plate is finished with a fine polish and is ready for insertion in the mouth. Metallic plates serving as the base of support for artificial teeth are constructed by stamping or swaging the flat plate cut approximately to the desired pattern, between male and female dies made from zinc and lead respectively, which have been obtained by casting the molten zinc into a sand matrix made from the plaster of Paris model of the alveolar arches. This furnishes a zinc model or male die, upon which a female die or counter-die of lead is cast, and between these the metallic base-plate is struck up to the form of the alveolar arch upon which it is intended to rest. Upon this base-plate porcelain teeth are fitted and attached by a metallic connection between the platinum pins (which for the purpose are baked in the porcelain texture of the artificial teeth) and the base-plate, union being made by soldering. Dentures upon an enameled platinum base-plate constitute a form of work known as continuous gum work, in which, after the teeth by means of their pins have been united to the plate by soldering with pure gold, porcelain paste or "body" as it is technically called, is packed around the roots and between the teeth; then carved into form until the natural contour is reproduced. The piece is then subjected to high heat in a muffle until vitrified, after the manner of firing or baking china or pottery. It is next given a coating of enamel in imitation of the natural gum color, and after this has been fused in the muffle and the piece finally finished, it constitutes the most artistic, hygienic, and anatomically perfect denture of which dental art is capable.

The prosthetic department includes, besides the restoration of lost teeth, the construction of mechanism for the correction of palatal defects, whereby imperfect speech and deglutition are restored to practically normal condition; it includes also the construction of splints in the treatment of fractures of the jaws and the restoration of parts of the jaws lost by accident or disease; construction of mechanism for the correction of irregular positions of the teeth and for the restoration of facial deformities due to irregular or imperfect development of the jaws and

bones of the nasal or facial regions. The correction of irregularities in the position of the teeth has developed such importance and covers such a wide field of study and work as to constitute a distinct specialty of modern dental practice. This department of dentistry is termed *orthodontia*; its importance is due not only to the cosmetic value of its results, but because of the direct bearing which irregular positions of the teeth and deformities of the dental arches exert upon the bodily health.

The whole field of dental and oral pathology has been so far developed by study and research as to place modern dental practice distinctly among the recognized specialties of the healing art. Most of the bacteria causing general bodily disease find access to the system through the mouth, which is also the habitat of many bacteria, benign and disease-producing as well. Hence the hygienic care of the mouth as a protection against disease invasion is of the utmost importance. Late researches have shown that the mouth, its tissues and its secretions, and the teeth themselves, furnish important indications of certain bodily diseases, malnutrition, etc., which are extremely valuable as diagnostic means. The training of the dental practitioner has therefore been enlarged so that in the foundation elements it is now coextensive with that of the practitioner of general medicine, but specialized with reference to its particular field of inquiry.

*Bibliography.*—Burchard, 'Text-book of Dental Pathology and Therapeutics' (1898); Essig 'Dental Metallurgy' (1900); 'American Text-book of Dentistry' (1900); Harris, 'Principles and Practice of Dentistry' (1896); Snale & Colyer, 'Diseases and Injuries of the Teeth' (1893); C. N. Johnson, 'Principles and Practice of Filling Teeth' (1902); also, 'American System of Dentistry,' Litch, in treatises by various authors (1886-97); Miller, 'Micro-organisms of the Human Mouth' (1890); Goadby, 'The Mycology of the Mouth' (1903).

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**Dentistry in the United States.** From the earliest times dentistry was practised as a branch of surgery. Herodotus speaks of means of preserving the teeth, and artificial teeth are alluded to by Greek and Latin poets. Within the last half century dentistry has become a distinct profession. The Baltimore College of Dental Surgery, established in 1839, was the first institution of the kind in the world. It was the direct result of an agitation to put dentists on a higher professional plane, and followed an unsuccessful attempt to found dental chairs in medical schools. It had been argued that oral pathology and dental mechanics should be taught in the medical schools as branches of medicine and that graduates choosing these courses should receive the degree of M.D. as in the case of other branches of medicine. In the same year the 'American Journal of Dental Science,' the first dental periodical in the world, was established. In 1845 the Ohio College of Dental Surgery (since 1888 the dental department of the University of Cincinnati), in 1856 the Pennsylvania College of Dental Surgery, in 1863 the Philadelphia Dental College were founded. These separate schools taught at first very little medicine, but paid attention almost



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entirely to mechanical training and to those branches which a dentist must know. All conferred the degree of D.D.S. In 1865 the New York College of Dentistry was founded with the purpose of educating men to practise dental surgery as a specialty of medicine. The curriculum included the fundamental departments of medicine with operative dentistry and oral prosthetics. In 1867 Harvard University opened a dental department and began to teach dentistry as a branch of medicine with the special degree D.M.D. (*Dentariae medicinae doctor*). In 1875 the University of Michigan and in 1878 the University of Pennsylvania followed the example of Harvard in opening dental departments. Forty of the 56 dental schools are now departments of other institutions. Since 1878 there has been a most astonishing increase in dental schools and dental students, due largely to the fact that the dental laws in many States now require graduation from a dental school as a condition for license. In 1878 there were 12 schools and 701 students; in 1902 there were 56 schools and 8,420 students. The number of practitioners of dentistry at present in the United States is about 27,000; upward of 60 institutions are devoted to the systematic education of dentists; the profession has an extensive literature of standard works and periodical publications, and the furnishing of supplies and material used in dental practice is an enormous industry involving millions of capital, a growth which has all developed within 60 years.

In 1840 the American Society of Dental Surgeons, the pioneer of the associations to which dentistry owes so much of its progress, was organized in New York. The National Association of Dental Faculties, organized in 1884, has done much to strengthen courses of study in dental schools. At the time of its organization only those schools were admitted which had proper facilities for instruction and a corps of competent teachers. From time to time standards have been raised by rules governing attendance, instruction, and graduation. There are at present 51 schools in the association, all of which require three full courses of dental lectures. The main defect of these schools as a rule is failure to require a sufficient preliminary general education for admission. The National Association of Dental Examiners was organized in 1883 to secure higher and more uniform standards for admission to dental practice. The entrance requirements of these associations are equivalent to at least two years of high school work.

In Alabama, in 1841, the first State law regulating the practice of dentistry was enacted. This was probably the first dental legislation in any country. The next State to pass a dental law was New York, but this action was not taken till 1868. The English law was enacted in 1878, and those of other countries about that time or later.

**Supervision.**—The practice of dentistry is now regulated by statute in 52 political divisions of the United States.

In Alaska and Indian Territory, no statutory enactments are given. Examining boards are appointed in Alabama, Kentucky, North Carolina and South Carolina by the State dental associations; in District of Columbia by district commissioners; in Indiana by the governor, State Board of Health and dental asso-

ciation; in Nebraska by State Board of Health; in New York by the University of the State of New York; in Philippines by the Board of Health; in the remaining divisions by the governor, on recommendation, usually, of the state dental societies.

**Licensing.**—Interchange of licenses is highly desirable and will doubtless be brought about to some extent in the near future. An important step toward interchange of licenses was taken in 1898 when the New York dental law was amended so that the Regents may now issue their license to any applicant who holds a license to practise dentistry granted by a State board of dental examiners, indorsed by the Dental Society of the State of New York, provided that his preliminary and professional education meets the New York statutory requirements. The dental examiners of Pennsylvania having been indorsed by the New York State dental society and recommended by the State dental examiners, the regents indorse Pennsylvania licenses granted under the new régime.

**Licentiates of Other States.**—Indiana admits licentiates of other States having equal requirements on "signification of reciprocal courtesy"; Illinois on approved diploma from reputable dental or medical college, or on 10 years' practice; New Jersey and Pennsylvania, on proof of license from other State boards having equal requirements; New Mexico and Utah, on proof of diploma recognized by National association dental examiners; New York, on proof of license from another State board having equal requirements and indorsed by the New York State dental society, or on graduation from a registered dental school and six years' practice; District of Columbia, Louisiana, Michigan, Missouri, Nebraska, Nevada, North Dakota, Oklahoma, South Dakota, Tennessee, Wisconsin, on approved diploma from other States; Kansas, Kentucky, Ohio, Texas, on approved diploma from a dental college in the United States or any foreign country. In the remaining political divisions no provision is made in the law for admission of licentiates of other States.

**Synopsis of Requirements, Jan. 1, 1904.**—In 33 divisions dental diplomas do not now confer the right to practise, an examination being required in all cases: Alabama, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Indiana, Iowa, Maine, Massachusetts, Minnesota, Mississippi, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Philippines, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, West Virginia.

The following require for admission to the licensing examination: Arizona, diploma recognized by N. A. D. E. or four-year high school course and three years' apprenticeship, or five years' practice.

California, diploma of reputable dental school indorsed by State board of dental examiners, or three-year high school course and four years' dental apprenticeship, or certificate of examining board of another State showing five years' practice.

Colorado, diploma from legally organized reputable dental school.

Connecticut, diploma from recognized dental school, or three years' instruction, or three years' practice.



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Delaware, diploma of recognized dental school.

Florida, diploma from reputable dental school.

Georgia and Hawaii, diploma from reputable dental school.

Idaho, three years' experience, certificate from another State board, or diploma from legally organized dental school.

Indiana, diploma recognized by N. A. D. F., or five years as assistant to licensed dentist.

Iowa, diploma from reputable dental school.

Minnesota, diploma from reputable dental school, or evidence of 10 years' continuous practice previous to September 1889.

Montana, diploma of reputable dental school, or five years' dental practice, or five years' study under licensed dentist.

New Jersey, common school education, diploma from recognized dental school or a written recommendation from five experienced dentists.

New York, full high school course, degree from registered dental school or medical degree with a special two-year dental course.

Ohio, diploma from legally chartered dental school.

Oregon, diploma from dental school in good standing, or study and practice in Oregon prior to this act.

Pennsylvania, three-year high school course, diploma of recognized dental school.

Philippines, diploma from legally incorporated dental school.

Utah, diploma recognized by N. A. D. E., or two years' practice or three years' study with licensed dentist.

Virginia, a fair academic education.

Washington, diploma from recognized dental school.

The following require the licensing examination only:

Alabama, Maine, Massachusetts, Mississippi, New Hampshire, North Carolina, Rhode Island, South Carolina, Vermont, West Virginia.

In the following political divisions either approval of dental diploma or examination by State or other duly qualified board is required:

District of Columbia, Illinois, Kansas, Kentucky, Louisiana, Maryland, Michigan, Missouri, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Tennessee, Texas, Wisconsin.

The following, requiring either approval of diploma or examination, admit to examination on:

Missouri, three years' study with legally registered dentist or license from another State.

North Dakota, three years' active practice or three years' study with practitioner.

South Dakota, three years' practice or three years' study with practitioner.

Wisconsin, diploma from approved incorporated dental school or four years' practice or five years' apprenticeship.

One State, Wyoming, requires only presentation of diploma to unqualified local officers.

Porto Rico admits to practice on diploma approved by the superior board of health.

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**Dentists.** About the time of the Revolutionary War, dentists came to the United

States from England and France. They included Woffendale, who arrived in 1766; Gardette, a French surgeon, 1778; and Lemaire, a French dentist, 1781, who accompanied the Comte de Rochambeau's army. While the Continental forces were in quarters at Providence, R. I., during the winter of 1781-2, Lemaire found opportunity for the practice of dentistry and also for the instruction of one or two students, particularly Josiah Flogg, who commenced practice in 1782, and was, so far as can now be ascertained, the first American dentist. John Greenwood, who became a practitioner about 1784, made sets of artificial teeth for General Washington. American dentists have made important contributions to the progress of dentistry. The dental engine, in its original form, was devised by Morrison in 1846. About 1855 Arthur discovered that gold-foil, which had previously been without cohesiveness, might be made cohesive by being passed through an alcohol flame. Atkinson first recommended the mallet as aid to the filling of teeth with gold. Barnum invented (1864) the rubber dam, which protects the field of operation from moisture during filling, and is also a means of excluding bacteria. Its value has been found to be decided. Richardson was the earliest to advocate (1857) the employment of a galvanic current as a means of inserting drugs into the tissues, though this method has been applied only comparatively recently. Wells discovered the application to dentistry of nitrous oxide, commonly known as "laughing gas." This is the anæsthetic now generally employed for extraction. Charles Goodyear in 1855 obtained in England a patent for a process of making a dental plate of hard rubber (caoutchouc). Artificial teeth were secured in this as a support before its vulcanization. Patents were also secured on subsequent improvements, and the vulcanite base has been of considerable benefit. The enameled platinum denture, used in what is sometimes styled the continuous gum method, was perfected by Allen in about 1846-7. By this method porcelain teeth are secured to a base-plate of platinum; a porcelain paste is then applied to the plate and covered with vitreous enamel. Mention should be made of the researches of Andrews, Black, and Sudduth in dental science. Numerous authoritative works on dental practice have been written and published in America. A 'History of Dental and Oral Science in America' (1876) was published by Dexter. Consult also Wedgwood, 'Progress of Oral Surgery' (1891).

**Dentition**, including both the formation and the cutting of the teeth, is one of the most important organic processes of childhood and adolescence. The pulpy nucleus constituting the tooth germ appears about the third month of pregnancy, and at the end of it the jaws contain the 20 follicles which are to produce the first teeth. Those of the second dentition appear from the fifth to the ninth month of fetal life, but some do not appear before the end of the second year. The first teeth are usually cut in the last six months of the first year. The central incisors of the lower jaw show themselves first, then come incisors of the upper jaw; the other teeth follow, proceeding in order from the centre backward, except in the case of the canines, which in general make their appearance only be-

## D'ENTRECASTEAUX ISLANDS — DENUDATION

fore the four last molars. The number of teeth is then 20. All are temporary and are replaced by those of the second dentition. The first dentition is usually completed during the last months of the second year. In some instances children have been born with teeth, and in many instances the first teeth do not make their appearance till after the 10th or even the 12th month. At the age of  $6\frac{1}{2}$  to 7, secondary teeth commence erupting and the first permanent molar, called the six-year molar, makes its appearance. At the same time the roots of the temporary teeth being resorbed the teeth themselves become loose, fall out, and are replaced in the same order as at the original cutting. The renewal of the incisors commences about the seventh and is not completed till the ninth year. Toward the 10th year the first permanent molar or bicuspid appears, next the canine, and then the second bicuspid. The bicuspids are of less size than the molars which they replace, the incisors and canines on the contrary are larger. On the regularity of these proportions depends the greater or less facility in the arrangement of the teeth subsequently cut. From  $10\frac{1}{2}$  to 11 years the second great molars appear, and last of all, usually from 18 to 25, the teething is completed by the cutting of the last molars or wisdom teeth. Besides the differences already mentioned between the first and second teeth, the incisors of the latter present on their anterior face two salient lines parallel to the axis of the tooth, and the roots of all of them are larger than those of the former. When the dental process is being performed the bones, which are its site, receive a development proportioned to the augmentation of the teeth in number and volume.

**D'Entrecasteaux Islands**, dän-tr-käs-tō, since 1884 part of the British protectorate of New Guinea, lie north of the southeast extremity of New Guinea; area 1,083 square miles. They comprise three chief islands separated by narrow channels. They are named after the French admiral and explorer, Bruni D'Entrecasteaux (1739-93), who visited these waters in 1792. His name is also preserved in D'Entrecasteaux Point on the southwest coast of western Australia; and in D'Entrecasteaux Channel, separating the south of Tasmania from Bruné Island. The islands contain boiling springs and other indications of volcanic action. The natives though described as head hunters are said to be skilled agriculturists.

**Denudation**, the laying bare of underlying rocks by the removal of superficial matter, and also the process by which the earth's surface is broken up and the loose material carried away, chiefly by the action of wind, rain, running water, frost, snow, ice, the sea, plants, and animals. The action of wind is seen in the erosion of rocks produced by the sand and grit which in certain dry regions is swept by the winds against projecting rocks, an action often resulting in the undermining of cliffs and the downfall of rock-masses. Rain is also a potent agent of denudation, its action being both chemical and mechanical. Rocks are more or less altered and decayed, and the decomposed materials carried off in solution by rain-water. In many places the rocks are thus "weathered" to considerable depths, the decomposed crusts varying in thickness from a mere line up to many

feet or even yards. The mechanical action of rain consists chiefly in the sweeping away of this disintegrated material. Running water acts also chemically and mechanically. Thus, the rain that sinks underground and rises to the surface again in springs, brings about many changes in rocks. Immense quantities of mineral matter are brought up in solution, and thus, in time, underground cavities are formed, especially in the more soluble rocks. In regions of calcareous rocks, the whole drainage is sometimes conducted underground. This action of underground water often brings about local subsidences, falls of rocks, and great landslips. The denuding action of superficial terrestrial waters is seen in the excavation of gullies, ravines, and river-valleys, one of the most remarkable examples of river erosion being the Grand Cañon of the Colorado (q.v.).

Frost acts with great intensity at high levels and in high latitudes, but even in temperate regions its action is very marked and productive of great disintegration of rocks. Glaciers are likewise powerful denuding agents. They are not only instrumental in transporting the rock-rubbish which is showered down upon them from overhanging cliffs, etc. (see BOULDERs), but by means of the blocks and debris which they drag forward on their beds, they grind, furrow, and smooth the rocks over which they flow. The sea, again, acts like a great horizontal saw, which is continually rasping away the rocks along the coast.

Nor can the destructive action of plants and animals be ignored. Plants send their roots into rock-crevices and wedging the masses asunder, aid the freer percolation of water, and prepare the way for the better action of frost. The destructive action of animals, again, is seen in the weakening of rocks on a sea-coast produced by the drilling and boring of *Saxicava*, *Pholas*, etc., and by annelids, echini, and sponges. Rocks so weakened fall more readily before the battering of waves and breakers. Little change may be perceptible, but an examination of the rocks shows that many thousands of feet of solid strata have been gradually removed from the surface of a country. Thus, in many districts where faults occur, no inequality at the surface betrays the presence of dislocations; the whole area has been reduced by denudation to the same level, hundreds or even thousands of feet of strata having been removed from the upcast side of the faults (see DISLOCATION). Denudation proceeds more rapidly in some regions than in others; therefore, the work of no individual river can be taken as a standard by which to estimate the general rate of erosion. Much depends on physical and climatic conditions, and much on the geological structure of a country and the composition of its prevalent rock-masses. Thus, the Mississippi is said to remove from the general surface of its basin one foot in 6,000 years, the Rhone one foot in 1,528 years, the Po one foot in 729 years. Rivers like the Rhine, the Danube, the Elbe, and the Rhone, contain in every 6,000 parts by weight one part of dissolved mineral substance. These rivers, therefore, carry seaward their own weight of dissolved matter in 6,000 years. Consult: Playfair, 'Illustrations of the Huttonian Theory'; Lyell, 'Principles of Geology'; Croll, 'Climate and Time,' and the standard text-books of geology.

## DENVER

**Denver, James W.**, American soldier and frontiersman: b. Winchester, Va., 1817; d. 9 Aug. 1892. He removed to Ohio with his father in 1830, where he studied for the bar. Later removed to Missouri, where he raised a company and served in the Mexican war. In 1850 he went to California where he became prominent in politics and was elected secretary of state, and afterward elected to the 34th Congress. Before the end of his congressional term he was appointed commissioner of Indian affairs, but resigned to accept the office of governor of the Territory of Kansas. He returned to Washington after 12 months of service leaving the territory well organized and law-abiding. He returned to California in 1859, but soon after removed to Wilmington, O. He served in the Union army during the Civil War until 1863. Gen. Denver suggested the name Colorado for the Territory formed out of Kansas, and the city of Denver was named in his honor.

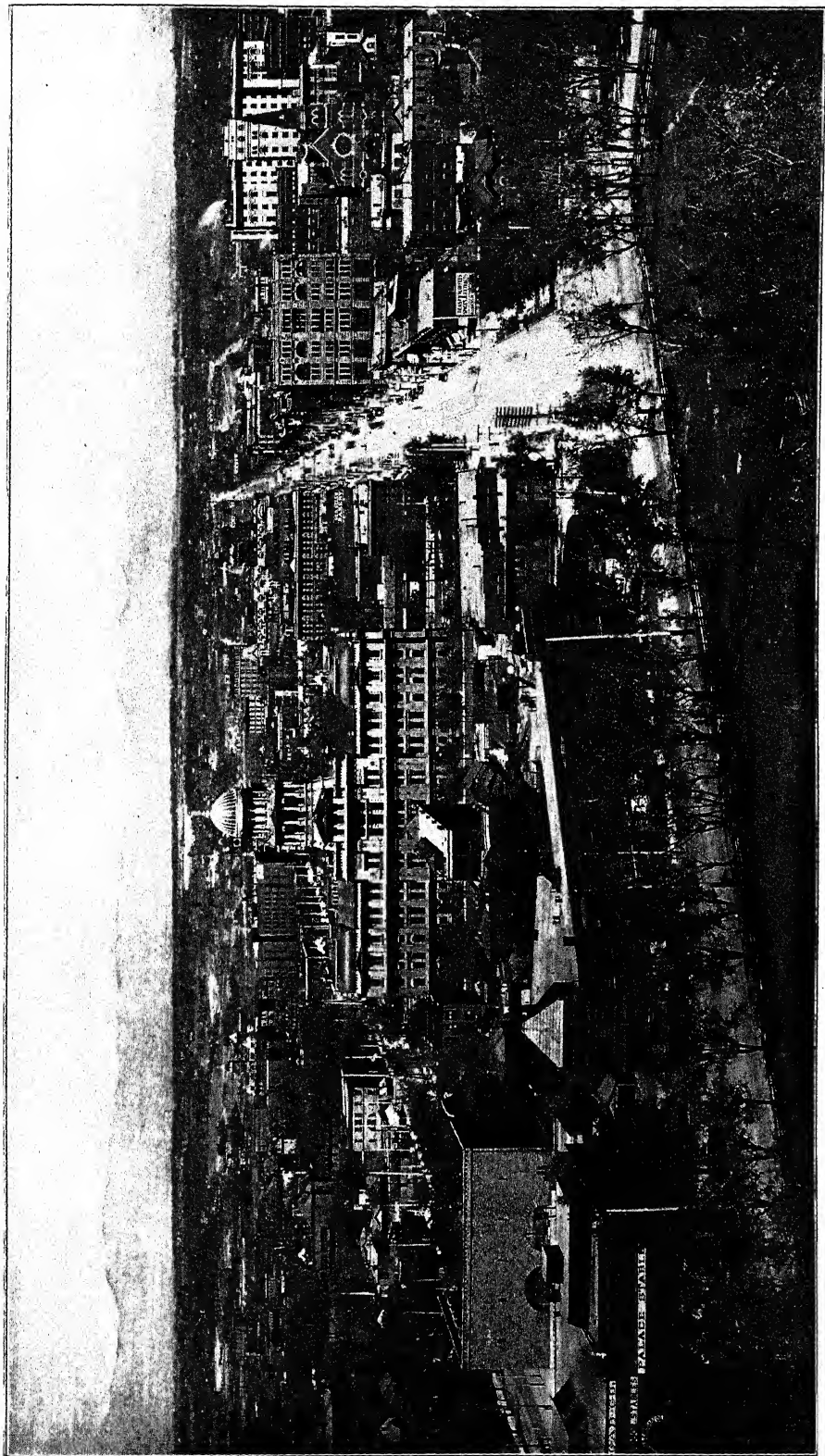
**Denver**, the capital of the State of Colorado, organized 17 Nov. 1858, and named in honor of Gen. James W. Denver, the first governor of the Territory of Kansas, which at that time included Colorado in its limits. It is 2,025 miles from New York; 1,457 miles from San Francisco; 639 miles west of Kansas City; 538 miles from Omaha; and is the chief metropolis of the entire Rocky Mountain region between the Missouri River and the Pacific coast. Its area is 54 square miles and its population is about 175,000; is the principal smelting centre in the United States, and its prosperity reflects the growth of the entire State, which produced (1902) gold, \$28,762,036; silver, \$12,488,774; lead, \$7,770,196; copper, \$1,293,011; total, \$50,314,019. The taxable property in Denver amounts to \$133,686,076, and its net public debt \$4,052,199. Denver lies at an altitude of one mile above the sea. The site is about 10 miles east of the base of the foot-hills of the Rocky Mountains in the valley of the south fork of the Platte River, at its junction with Cherry Creek, a dry stream, which carries running water only at intervals.

The climate of Denver is one of the most delightful and remarkable in the country. The data for the years 1897 to 1901 from the United States Department of Agriculture gives the following information: "Discarding fractions of a degree, the mean annual temperature at Denver is 50°, as against 48° at Chicago, 49° at Boston, 55° at Washington, 56° at St. Louis, and 69° at Jacksonville. During the last 32 years, 100° or higher has been touched just 13 times in Denver—7 times in July and 6 in August. While these high temperatures were maintained only for a few minutes, readings in the 90's are common during every summer month. For July, the warmest month, the average temperature is 72°, and the average daily maximum, or afternoon reading, is 87°. Here, as elsewhere, over the greater part of the United States, the coldest month is January, with an average temperature of 29°. The annual precipitation, which includes rain, snow, sleet, and hail, is 14.00 inches. Chicago, 34.8; St. Louis, 41.1; Washington, 44.8; Boston, 45.0; and Jacksonville, 54.1. Of sunshine Denver has 69 per cent of the possible, as against 65 at St. Louis, 59 at Washington, 54 at Boston and 53 at Chicago. The average

relative humidity is slightly below 50 per cent. It is highest in February, 55 per cent, and lowest in June, which has an average of 46 per cent. Twice during my residence of 21 years in the State have we observed a humidity as low as one half of 1 per cent. The annual relative humidity at St. Louis is 70 per cent, Boston 72, Washington 73, Chicago 77, and Jacksonville 80, and for the warmer months—June, July, August, and September—at St. Louis 66 per cent, Chicago and Boston 74, Washington 76, and Jacksonville 82. It will be observed that in the Atlantic States the humidity during the warm months is greater than the annual, just the reverse of that which obtains at Denver. In brief, Denver summers are characterized by warm days and cool nights, the heat of the day not attended by the usual debilitating effects; the winters by an abundance of sunshine, and the general absence of snow and of severe and long continued cold."

The public utilities of Denver are modern in every particular. The street cars are operated by the overhead trolley system, cover some 150 miles of streets; carry each year over 50,000,000 passengers. Gas, electric light and electric power are furnished by the Denver Gas and Electric Company, and the Lacombe Electric Company. The Denver City Steam Company supplies many business buildings with steam-heat, and operates 10 miles of pipe line. Telephonic communication is had between Denver and 227 of the principal towns in Colorado, Wyoming, and New Mexico. Denver's supply of water is furnished by the Denver Union Water Company, which takes its water from the Platte River, Bear Creek, and Cherry Creek. The greater portion of the waters are taken during the non-irrigating season and stored in large and extensive reservoirs. The waters from these reservoirs percolate through natural filter beds of sand, before entering the city mains. Probably no city in the world possesses better drinking water. As a commercial city Denver is increasing in importance each year. In manufacturing it produced in 1890 some \$30,000,000 worth of products; in 1902 \$48,750,000 represents the value of goods made in this city. As Denver's trade territory increases in population, its jobbing trade also increases, and in round numbers the wholesalers of this city sold in 1902 approximately \$50,000,000 worth of goods. Denver's banking and financial institutions are strong. The five national banks of the city reported their deposits for 1902 as amounting to \$43,852,605.

No educational advantage is denied any pupil in Denver's free schools. They start with the children in the kindergarten and carry them through 12 grades ready to enter college, or with a fair education in all branches of study if school life is to end with the public school. Besides the regular grammar and high school studies, the children may have manual training, special training in cooking and sewing, modern and ancient languages, music and drawing, with special preparation for advanced work in technical schools. The school property is valued at about \$4,000,000; annually there is spent for maintaining the schools about \$800,000. In addition to the city library are a medical library, several thousand volumes, six law libraries, school libraries containing 60,000 volumes,



DENVER, COLORADO.



exclusive of text-books, and at the capitol building a State library numbering over 15,000 volumes.

Denver has 4 daily newspapers, 35 weekly papers, and a number of trade journals. The city has 12 parks, with a total area of 550 acres, the largest, the city park, contains 320 acres. Denver has 156 church buildings. The public works have kept pace with the advance in other directions. Extensive storm and sanitary sewer systems, carefully graded, curbed, and paved streets, uniform sidewalks of first-class material, and massive steel viaducts are some of the indications of the progress. In 1902 there were 62 miles of sidewalks laid and 45 miles of streets graded and rounded ready for paving or surfacing. The estimated cost of the improvements now under way in 1903 amounts to \$1,068,338.

Several great transportation companies centre in Denver, four of which continue across the continent and one, the Denver, Northwestern & Pacific Railroad, now in construction, will make the fifth. The Union Pacific Railway takes its passengers through Denver to the western coast by the way of Cheyenne and Ogden; the Burlington & Rock Island transfers its passengers to the Union Pacific, Rio Grande, or Santa Fé for continuance of the journey. The Santa Fé, whose main line extends south of Denver across the continent through New Mexico and Arizona, makes southern connection for Denver. The greatest transportation enterprise of recent years is the construction of the Denver, Northwestern & Pacific Railroad, which was completed in 1903. By this road the distance between Denver and Salt Lake is 100 miles shorter than by any other route.

AARON GOVE,  
Superintendent of Schools.

**Denver, University of**, a coeducational institution, in Denver, Col.; founded in 1864 under the auspices of the Methodist Church. Until 1880 it was called Colorado Seminary. The university is now composed of seven colleges; nine of the departments are at University Park, a suburb of Denver, and three in the city. The Chamberlain Observatory, which owns a very large telescope, is at University Park. In 1902 there were connected with the university 133 professors and instructors and 1,167 students.

**Deobund**, *dē'* or *dā'ō-bünd*, or **Deoband**, India, city in the Saharunpur district, Northwest Provinces; an ancient place, with manufactures of fine cloth and a grain trade. It has many temples, and is much resorted to by pilgrims. Pop. 19,250.

**Deodand**, *dē'ō-dānd* (*Deo dandum*, a thing to be given or dedicated to God), an obsolete legal term for anything that had caused a person's death, all such chattels being, by the old rule of the common law of England, forfeited to the king, to be devoted by him to pious uses, though often finding way to his privy purse. In all indictments for homicide, the grand-jury specified the instrument that immediately caused the death, and its value, that the king might claim the deodand and distribute it "to appease God's wrath." Though these forfeitures were originally incurred to the king, yet they were frequently granted to the lord of the manor or territory upon which the death

happened. Deodands were abolished in 1846. There has never been anything analogous to this custom in the United States.

**Deodar**, *dē-ō-dār'* ("divine tree"), from the Sanskrit *devadaru*, a tree (*Cedrus deodara*), a native of the mountains of India, where it grows to the height of 100 feet and upward. It chiefly resembles the cedar of Lebanon in habit of growth, and is probably a species of the same genus. The timber is among the most valuable grown in India. The name is rather freely applied to trees, especially to species of the *Conifera*. See CEDAR.

**Deodorizer**, a substance used for absorbing foul-smelling gases, or for substituting an odor which is pleasing for one that is disagreeable. Deodorizers are not disinfectants or antiseptics, and should not be confounded with them. They are of no use save to cover up disagreeable smells, and often do a great deal of harm by shutting people's nostrils to real signs of danger.

**De Officiis**, *dē o-fish'i-is* (Lat. "of duties"), a treatise in three books by Cicero, on moral obligations written about 44 B.C.

**Deogarh**, *dē'* or *dā'ō-gūr*, India, the name of several cities, of which the following two are the chief: 1. In Bengal, 170 miles northwest of Calcutta; it contains a group of temples to which numerous pilgrims resort. Pop. 8,667. 2. In Oodeypore, Rajputana; its chief attraction is an old palace. Pop. 7,400.

**D'Eon de Beaumont**. See EON D' BEAUMONT, CHARLES.

**De Oratore**, *dē or-ā-tō'rē* (Lat. "of the orator"), a rhetorical work by Cicero, in three books, written about 55 B.C. It is in the form of a dialogue, the principal characters being L. Crassus and M. Antoninus. This work ranks with the most finished productions of Cicero on account of its varied contents and its excellent style.

**Department**, the name given certain territorial divisions of countries, especially to the principal territorial divisions of France. At the time of the French Revolution, when the former division of the kingdom into provinces was abolished, and succeeded by a division of it into departments, this division was determined partly by the number of inhabitants, partly by extent of territory, and partly by the amount of direct taxes. The new division was proposed in the Constituent Assembly in 1789, and effected in 1790. The whole kingdom was at first divided into 83 departments, which were subsequently increased by the gradual extension of the empire to 130, and were reduced by the Peace of 1814 to 86. By the cession of Savoy and Nice to France in 1860 the number of the French departments was increased to 89, and by the cession of Alsace-Lorraine to Germany in 1871, the number was reduced to 87. Most of the states of South America are also divided into departments (*departimientos*), but these resemble the French ones in nothing but the name. Each French department is subdivided into *arrondissements*, these again into cantons, and these again into communes. The name is, also, applied to military divisions, and to various other divisions as of government and schools.



## DE PAUW — DEPILATORIES

**De Pauw, Washington Charles**, American manufacturer: b. Salem, Ind., 4 Jan. 1822; d. New Albany, Ind., 5 May 1887. He received a liberal education; worked himself up to the foremost rank among the business men of his State; and was successively a mill-owner, a merchant, and a banker. He was noted for his extensive gifts in behalf of education. His aid to the Indiana Asbury University set it upon a sound basis, and its name was changed to De Pauw University in his honor. He also founded De Pauw College for Women, and several charitable institutions at New Albany, Ind. See DE PAUW UNIVERSITY.

**De Pauw University**, a coeducational institution in Greencastle, Ind.; founded in 1837, under the auspices of the Methodist Episcopal Church, and known as the Indiana Asbury University until 1884, when the name was changed to De Pauw University. In 1902 there were in attendance 515 students with 29 professors and instructors; number of volumes in library 17,500; grounds and buildings valued at \$300,000; productive funds, \$290,000; benefactions, \$7,500; income, \$28,500; number of graduates, 2,110; president, H. A. Gobin, D.D.

**De Pere, dé-pêr' or dê-pâr'**, Wis., city in Brown County; on the Fox River at the head of steamer navigation, and on the Chicago & Northwestern, and the Chicago, Milwaukee & St. Paul railroads, about 100 miles north of Milwaukee. Pop. (1900) 4,038.

**Depew, Chauncey Mitchell**, American lawyer, legislator, politician, and orator: b. Peekskill, N. Y., 23 April 1834. He was graduated from Yale College in 1856, studied law in Peekskill and in New York, and was admitted to the bar in 1858. He was soon after elected to the New York Assembly, and served as chairman of the committee on ways and means. For a time he was acting speaker of the house. In 1863 he was nominated upon the Republican ticket for secretary of state, and was elected by over 30,000 majority. In 1865 he declined a renomination. President Grant tendered him the Japanese mission about this time, but Dr. Depew declined the office, to enter the service of the New York & Harlem Railroad, as attorney. In 1869, when the consolidation occurred of the Hudson River, Harlem and New York Central R.R.'s he was made a director and attorney for the newly organized company.

In 1872 he accepted the nomination for lieutenant-governor on the Republican State ticket, but was defeated by a small plurality. In 1875, he became general counsel for the entire Vanderbilt system of railroads, and in 1882, second vice-president of the reorganized New York Central & Hudson River Railroad, and president in 1885. The same year Yale College conferred upon him the title of LL.D. During this period he was acting as a regent of the State University. He remained president of the New York Central until 1898, when he became chairman of the board of directors of the Vanderbilt system, which included the New York Central & Hudson River; Lake Shore & Michigan Southern; Michigan Central, and the New York, Chicago & St. Louis railroads.

His political career during these later years was eventful. In 1885 he declined the election to the United States Senate. In 1888 he figured

prominently as a candidate for the presidential nomination at the National Republican Convention, withdrawing from the contest in favor of Benjamin Harrison of Indiana, who, after his election and elevation to the presidency, tendered to Mr. Depew the portfolio of secretary of state, which was declined owing to large railroad interests. In 1899, on 17 Jan., he was elected to the United States Senate as junior member from New York State. Since 1885 Dr. Depew has been regarded as one of the leading Republicans of the country. Dr. Depew was married in 1871 to Elise Hegeman, who died 1893, leaving one son. He was married again in 1902 to Miss Palmer.

Dr. Depew's fame abroad is even greater than in the United States. In London and Paris he is regarded as America's representative citizen, and is interviewed and dined accordingly when he makes his annual summer pilgrimage to Europe. This world-wide fame rests largely upon his ability as orator, after-dinner speaker, and lecturer. He delivered important addresses at the Washington Centennial at New York in 1889, and the dedication of the World's Columbian Exposition, at Chicago, in 1893, and orations at the memorial services of President Garfield and General Sherman. As a wit and humorist, Dr. Depew has acquired a name second to none in this country, and he has been in great demand for many years at annual dinners and banquets, as the chief after-dinner speaker. He has published collections of his orations and after-dinner speeches in one volume (1890), and his later speeches (1894). Consult: Clemens, 'Depew Story Book' (1898).

**De Peyster, dè pîs'ter, Abraham**, American merchant: b. New York 8 July 1658; d. there 10 Aug. 1728. He was the eldest son of Johannes DePeyster (q.v.); and filled many important public offices after the final cession of the New Netherlands to Great Britain. Between 1691 and 1695, he was mayor of New York, and subsequently became chief justice of the province, and president of the king's council, in which latter capacity in 1701 he acted as colonial governor. He was also colonel of the forces of New York, and treasurer of the provinces of New York and New Jersey.

**De Peyster, Arent Schuyler**, British military officer: b. New York 27 June 1736; d. Dumfries, Scotland, November 1832. He was a grandson of Abraham DePeyster (q.v.). In the American Revolution he was a colonel in the Royal army; was at different times in command of the British posts of Detroit, Mackinac, and elsewhere in Canada.

**De Peyster, Johannes**, American colonial merchant: b. Haarlem, Holland, 1600; d. New York about 1685. He was one of the early settlers of New York; and became prominent in public affairs during the Dutch possession; was one of the last to swear allegiance to the Crown after the English succeeded to the government; served several times as alderman and deputy mayor, and was frequently urged to become mayor by the English residents, but declined from ignorance of the language.

**Depil'atories** ("I pull out the hair"), applications used to remove the hair from the body, especially the face and scalp, without injuring the texture of the skin. Quicklime and or-

piment are the most common ingredients. The most celebrated depilatory is the *rusma*, used by Oriental nations, which consists of quicklime and orpiment (tarsulphure of arsenic) boiled in water impregnated with a strong alkaline lye. The parts which are to be deprived of hair are rubbed with this mixture, and after a time washed in warm water. This depilatory acts with great energy, and the utmost care is necessary in using it that it may not irritate and injure the skin. Sometimes a plaster of pitch and rosin is used for the same purpose. The best and most effective means of removing the hair to-day is by means of a galvanic current, and needle electrode, which is applied directly to the hair-follicle, thus killing it. This procedure is sometimes called electrolysis.

**Depo'nent**, (1) in grammar, a verb which is passive in the conjugation of its tenses, but is not construed according to the usual passive English form. The old grammatic fiction was that such a verb laid aside (*deponens*, laying aside) its passive meaning, but, though somewhat convenient as an aid to classification, this explanation of the form is logically and philologically unsound. (2) In law, a person who depones or makes a deposition; one who gives his testimony in a court of justice; a witness upon oath. See DEPOSITION.

**Deposing Power of the Popes**, their power, on whatever ground based, to depose sovereigns from their thrones and to annul their subjects' obligation of allegiance. It was the universal belief of the Christian world in the Middle Ages, that if a Christian prince fell into heresy and persisted therein against the admonitions of the Church, the pope might lawfully excommunicate him and procure his deposition, invoking the aid of orthodox princes and of the offender's subjects in making the decree of deposition effective. Such was the consentient teaching of divines and canonists, of church councils and of popes, though not laid down with all the formalities requisite to make such papal supremacy an article of faith. Of course the sovereign against whom the decree was fulminated usually protested and denied the pope's right to depose, or at least denied the justice of the grounds on which the decree was based, still his resistance to the Pope was regarded as rebellion against the decision of the highest court of Christendom. The Lateran council of 1215 directs that if a sovereign persists after warning in letting heresy grow and spread in his dominions, the bishops of the realm should excommunicate him. If he heeds not that judgment, the Pope is to be advised of that fact to the end that he may "declare the vassals of that prince absolved from their allegiance, and invite Catholics to occupy the country." The proceeding was in entire accord with the law of nations as understood in those times; and emperors and kings were crowned and consecrated on the understanding that they held their scepters subject to just such conditions. As Fénelon says, "The Church neither deprived nor appointed lay rulers, but only replied, when the natives consulted it, explaining what concerned the conscience in regard to the political contact or the oath. This is not," he continues, "a juridical and civil, but only a directive and ordinative power." The most explicit assertion of the Pope's deposing power is seen in the celebrated constitu-

tion *Unam Sanctam* (1303) of Boniface VIII., who in substance teaches that "both swords, the spiritual and the material, are in the power of the Church, but the latter is to be wielded for the Church, the former by the Church: one by the hands of kings and magistrates, but at the pleasure and sufferance of the priest. One sword must be under the other, and the temporal authority must be subject to the spiritual power." But the claim is no longer made, and the papacy accepts the situation of the Church as it is now, without thought of striving for a return of the ancient order. In the words of Pope Pius IX., "No one now thinks any more of the right of deposing princes which the Holy See formerly exercised; and the supreme pontiff less than any one."

**Depos'it**, in geology, a layer of soft or hard matter formed by the settling down of mud, gravel, stones, detritus, organic remains, etc., which had been held in suspension in water. Marine deposits are those formed on sea bottoms; lacustrine, those formed at the bottoms of lakes; fluvial, those formed on river bottoms; and so on. In contradistinction to bed or layer, which is matter more evenly distributed during formation, a deposit is nearly always irregular in form. See GEOLOGY.

**Deposit**, a term of wide meaning in law, but especially applied to money paid as an earnest or security for the performance of a contract; also to money belonging to one person intrusted to the safe-keeping of another, to be kept without fee, and to be re-delivered on demand. When such a deposit is made to a bank or trading company, interest, according to agreement, is generally paid on it. The person who makes the deposit is called the depositor, and the person who receives the deposit is called the depositary. By the civil law, deposits are divided into two classes, necessary and voluntary. The first class is where the depositor is compelled by some sudden emergency, such as fire or shipwreck, to confide his property to some one, without having opportunity for choosing his depositary. The second class is where the deposit is made by the mutual consent of the parties. Besides such deposits of money received by banking or commercial companies with a view to employing it in their business, a merchant or commercial company frequently deposits with a bank documents, such as deeds or bonds, as security for the payment of a loan.

**Depos'ition**, in law, testimony given in court by a witness upon oath; also the written testimony of a witness by way of answer to interrogatories; or affidavit certified by a notary public. When a witness himself can be produced his deposition cannot be read in court.

**Deposition of Metals**. See ELECTROPLATING.

**Depot**, *dē'pō*, Fr. *dā-pō*, a French word in general use as a term for a place where goods are received and stored; hence, in military matters, a magazine where arms, ammunition, etc., are kept. The term is now usually applied to those companies of a regiment which remain at home when the rest are away on foreign service. In the United States it is the common term for a railway station.

**Depres**, or **Despres**, *dā-prā*, *Josquin*, *zhōskān dē-prā*, Dutch musician: b. Hainault about 1450; d. Conde, 27 Aug. 1521. He is reckoned

## DEPRESSION — DE QUINCEY

the greatest of the early contrapuntists, but little is known of his personal history. He composed numerous celebrated masses and songs.

**Depression, or Dip.** See HORIZON.

**Depretis, dā-prā'tēs, Augustin,** Italian statesman: b. Mezzana-Corte-Bottaroni, near Stradella, 31 Jan. 1813; d. there 29 July 1887. He was identified with Italian politics from 1849, when he was made civil governor of Brescia, and in 1861 was sent to Sicily as pro-dictator for Garibaldi. He served in a number of the Italian ministries, beginning in 1862 as minister of public works under Rattazzi. Under Ricasoli in 1866-7 he was minister of marine, and afterward held the portfolio of finance. In 1876 he was called to form a ministry himself, and while acting as president of the council and minister of finance he instituted many reforms in the government. In 1879 he resigned, and Carlioli formed a government, but Depretis was again placed at the head of the council in 1885, and remained there until his death.

**Deprivation,** the removing of a clergyman from his benefice on account of heresy or misconduct. It entails, of course, loss of all emoluments, but not the loss of clerical character, except it be *deprivation ab officio*, or deprivation of order, which then becomes deposition or degradation. The lighter punishment, simply taking away a clergyman's living or preferment, is called *deprivation a beneficio*.

**De Profundis,** the 130th of the Psalms of David (129th in the Douay version); one of the seven psalms, expressive of sorrow for sin and desire for pardon, used in the liturgy of the Roman Catholic Church, and called the Penitential Psalms. The name *De Profundis* comes from the Latin version of the first words of the psalm, "Out of the depths." See PENITENTIAL PSALMS.

**Deptford, dēt'fērd,** England, a metropolitan and parliamentary borough of greater London, formerly a town in Kent and Surrey. In the reign of Henry VIII. a dockyard was established in this place, then known as Deptford Strond. It was in this dockyard that Peter the Great of Russia served as an apprentice and learned ship-building 1691. The London Cattle Market (area 30 acres) occupies the site of the old dockyard. The Royal Victoria Victualling Yard, the largest army and navy supply depot, is located here.

**Deputies, Chamber of,** the lower of the two legislative chambers or second house of national parliament in France, Italy, Spain, Portugal, and Rumania. The first French Chamber of Deputies was established under Louis XVII. in 1814. By enactments introduced in 1830, any citizen of 30 years and upward who paid direct contributions to the extent of 500 francs might be elected as a deputy. Originally the chamber was elected for five years, in 1824 it became septennial, and in 1830 it was again limited to five years. In France (1903) the chamber consisted of 591 members, elected for four years by universal suffrage. In Italy the members numbered 508; in Portugal 148; in Rumania 183. In Spain the deputies number one to every 50,000 inhabitants.

**Deputy,** a lieutenant or substitute who exercises power which properly belongs to another who has placed him in his stead. The ap-

pointment of a deputy does not free the principal from responsibility. A deputy must take an oath of office. His salary is paid by the government. If authorized for the time being to act with full power of his principal, he is called a general deputy, and may act in his own name. Otherwise when acting in a particular and limited matter he is only a special deputy.

**De Puy, dē pū, Henry Walter,** American miscellaneous writer: b. Pompey Hill, Onondaga County, N. Y., 1820; d. 2 Feb. 1876. He constantly contributed political articles to the press; wrote several popular poems, and was the author of 'Kossuth and his Generals,' with a brief history of Hungary (1851); 'Louis Napoleon and his Times,' with a memoir of the Bonaparte family (1853); 'Three Score Years and Beyond' (1873); etc.

**De Puy, William Harrison,** American Methodist clergyman: b. Penn Yan, N. Y., 31 Oct. 1821; d. Canaan, Conn., 4 Sept. 1901. He was the editor of the Methodist Year Book 1866-89, and was associate editor of the New York 'Christian Advocate' for 25 years. He published: 'Compendium of Useful Information' (1878); 'The People's Cyclopedia of Useful Knowledge' (1879); 'Home and Health and Home Economics' (1880); 'The People's Atlas' (1882); 'University of Literature' (1896).

**De Quincey, Thomas,** English essayist: b. Greenhay, near Manchester, 15 Aug. 1785; d. Edinburgh 8 Dec. 1859. He was a boy of remarkably quick and precocious abilities, and acquired such great proficiency in classical studies that the master of the school which he attended pointed him out on one occasion to a stranger with the remark, "That boy could harangue an Athenian mob better than you or I could address an English one." His father died in 1793 and young De Quincey was extremely urgent with his guardian to send him to the University of Oxford; and his importunities proving unsuccessful, he ran away from the Manchester grammar-school with 10 guineas and a volume of Euripides in his pocket. He directed his steps first to North Wales, and afterward wandered up to London, where he arrived in May 1800, in an absolutely destitute condition, with his store of money exhausted, and not a friend to whom he could apply. For 16 weeks he roamed through the streets of the metropolis, unprovided with food or shelter, except such as was furnished him by charitable persons. He was at last discovered by his family and sent to Worcester College, Oxford, where he remained till 1808. Having been afflicted with rheumatism in the autumn of 1804, he was induced to alleviate the pain by doses of opium, and a foundation was thus laid of a pernicious habit, which in his case, as in that of Coleridge, proved extremely deleterious both to physical and mental health. For the first 10 years, however, of his addiction to the practice, the evil results were not perceptible, and in the possession of a sufficient fortune, a genial circle of friends, and freedom from bodily ailments, he spent the life of a learned and speculative voluptuary. In 1804 he had first become acquainted with Charles Lamb, and in 1807 with Coleridge. In 1809 he took a lease of the cottage of Grasmere, Westmoreland; previously occupied by Wordsworth, and there, in that beautiful locality, in the

## DERA — DERBY

neighborhood of Wordsworth, Southey, and other literary friends, he continued to reside for upward of 20 years. In 1813 a severe derangement of his stomach forced him to increase his doses of opium, which he now took regularly every day. In 1816 he married; and in 1821, making a strong effort to shake off his habitual indolence, he commenced his 'Confessions of an English Opium Eater,' which appeared in the London 'Magazine' for that year, and were published in a collected form in 1822. In 1843 he took up his abode at Lasswade, Mid-Lothian, and here he remained almost to the end of his life. The latest, most complete, and best edition of his works is that published 1889-90, under the editorship of Prof. David Masson, in 14 volumes. See Japp (H. A. Page) 'Life of De Quincey' (1890); Findley, 'Personal Recollections of De Quincey' (1885); Stephen, 'Hours in a Library.'

**Dera**, dēr'a (a word derived from the Arabic "der," a monastery), the name of several towns in British India, the two principal places so designated being Dera Ghazi Khan, capital city of a district of the same name in the province of Punjab, about four miles west from the Indus River, in lat. 30° 4' N., and lon. 70° 50' E. It is a British military station, is situated on the Sindh-sagar Railroad, and contains many stately religious buildings and mosques. Pop. 23,899; and Dera Ismail Khan, capital city of the government district of Deradschat, in the Punjab, about eight miles west from the Indus, in lat. 31° 50' N. and lon. 70° 59' E. It comprises an English and Indian city, in the former of which is a British garrison, two regiments of infantry, one of cavalry, and one battery of artillery. The Indian city is surrounded by a mud wall, and occupied by noble native families. It is a trade depot for Afghanistan. Pop. 21,573.

**Dera Ghazi Khan**, dēr'a gā-zē' kân, India, a district and a town in the Punjab, in the division of Derajat. The district lies entirely on the right bank of the Indus, and consists of a sandy strip of low land shut in between the Suleiman Hills and the river. The town lies about two miles from the Indus, has many striking mosques, town-hall, court-house, handsome bazaar, cantonments, etc. Pop. of the town 27,886.

**Dera Ismail Khan**, ēs-mā-ēl' kân, India, a district and a town in the Punjab, in the division of Derajat. The district lies north of that of Dera Ghazi Khan on both sides of the Indus, and is in great part barren and sandy. The town is situated four and one half miles west of the Indus, and is the administrative headquarters of the Derajat division as well as of the Dera Ismail Khan district. There are here various government offices, cantonments for troops, and an important station of the Church Missionary Society. It is a somewhat straggling town on a level plain. Pop. 26,884.

**Derajat**, dēr-a-jāt, a division or commissionership of India, forming a portion of the Punjab, and occupying part of the valley of the Indus. It comprises the districts of Dera Ghazi Khan, Dera Ismail Khan, Muzaffargarh, and Bannu. Much of it is sandy and uncultivated, but many parts are well cultivated, and irrigation is largely employed. The area under

cultivation is increasing rapidly. Area 22,315 square miles. Pop. 1,643,603.

**Derbend**, dēr-bënd, or **Derbent** ("gateway"), Russia, a port and capital of the district of Daghestan, on the western shore of the Caspian, 140 miles northwest of Baku. It is charmingly situated among vineyards and orchards and fields of maize and madder, on the declivity of a branch of the Caucasus, which here approaches very close to the water's edge. It is surrounded by ancient walls. The harbor is inaccessible to all but small vessels; but a considerable trade is done at the four large markets held here yearly. Silk and cotton fabrics, earthenware, and weapons are manufactured, and saffron is cultivated. It was long considered the key of Persia on the northwest side. It was captured by the Arabs in 728, by the Mongols in 1220, and frequently changed hands before it was formally incorporated with Russian Caucasia in 1813.

**Derby**, Earl of, a title conferred in 1485 on Thomas, second Lord Stanley, two months after Bosworth Field, where he and his family had greatly contributed to Richmond's victory. The Stanleys were descended from Adam de Aldithley, who attended William the Conqueror to England, and whose grandson, having married the heiress of Thomas Stanley, of Stafford, exchanged the Manor of Thalk in that county, which he had received as his wife's marriage-portion, for that of Stoneley, in the county of Derby, and afterward assumed the surname of Stanley. In 1405 Sir John Stanley, who had married the heiress of Lathom, obtained a grant of the Isle of Man, which he and his descendants ruled till 1733.

**Derby**, Edward Geoffrey Smith Stanley, 14TH EARL OF, English statesman: b. Knowsley Park, Lancashire, 29 March 1799; d. there 23 Oct. 1869. In 1820 he was returned to the House of Commons as member for Stockbridge, in Hampshire. His very first speech marked him out as a skilled debater, and he rapidly rose to distinction in the House. His views at first inclined him to side with the Whig party. In 1827 he joined Canning's ministry as under secretary for the colonies; and became chief secretary for Ireland and Lord Grey. The opposition, led by O'Connell in the House of Commons, was powerful and violent; but while he firmly resisted the extravagant demands of the opposition, and the agitation for the repeal of the union, he succeeded in passing a number of measures which tended to lessen the prevailing discontent. He improved the administration of justice, carried a bill establishing a system of national education, and afterward, as secretary of state for the colonies supported the bill for the reform of the Irish Church, by which two archbishoprics and 10 bishoprics were abolished. He also gave his warm support to the petitions which were presented to Parliament for the abolition of slavery in the British colonies, and was successful in passing the act for this purpose in 1833. He now joined the Tories; and accepted office under Sir Robert Peel, being again appointed colonial secretary. He distinguished himself by his wise administration of this department during the four following years. In 1851 and 1858 he was commanded by the queen to form a ministry, but on both occasions he had to contend against a majority

## DERBY — DERBYSHIRE SPAR

in the House of Commons, and was able to maintain himself in office only for a short period. He was more successful in 1866, when, on the defeat of Lord John Russell's government on one of the chief clauses of their reform bill, he undertook to form a ministry. His administration on this occasion was signalized by the reform of the government in India, the successful conduct of the Abyssinian war, and the passing of the reform bill which introduced household suffrage as the qualification for the electoral franchise. Earl Derby joined to great ability as a statesman, and brilliant oratorical powers, a high degree of scholarly culture and literary ability. Among other works he published a successful translation of Homer's *Iliad* (1864). See Kebbel, 'English Statesmen Since the Peace of 1815: Derby' (1869); Saintsbury in Reid's 'Prime Ministers of Queen Victoria' (1892).

**Derby, Edward Henry Smith Stanley,** 15TH EARL OF: b. Knowsley, Lancashire, 21 July 1826; d. there 21 April 1893. He was educated at Rugby, and Trinity College, Cambridge. In 1852 he was under secretary of foreign affairs; afterward secretary of state for India. Under his superintendence the management of the British India empire was transferred from the East India Company to the government of Great Britain. In 1866 and also in 1874 he was secretary of state for foreign affairs. Lord Derby became a Liberal in 1879, and was secretary of state for the colonies under Mr. Gladstone from 1882 to 1885. He, however, took a stand against Irish Home Rule in 1886 and afterward ranked among Mr. Gladstone's opponents.

**Derby, George Horatio,** pen name "JOHN PHOENIX," American humorist: b. Dedham, Mass., 3 April 1823; d. New York 15 May 1861. He was graduated at West Point (1846), and served in the army during the Mexican war (1846-7). He wrote under the name "John Phoenix" a series of sketches and burlesques, entitled 'Phoenixiana' (1855); and 'The Squib-bob Papers' (1859).

**Derby, Orville Adelbert,** American geologist: b. Kelloggsville, N. Y., 23 July 1851. He graduated from Cornell University in 1870, made trips to Brazil in 1870 and 1871; and was instructor at Cornell in 1873-5. In 1875 he became a member of the Brazilian geological commission, and has since been engaged in geological work in Brazil, being at one time curator of the geological department of the National Museum, and holding the position of chief of the geographical and geological survey of São Paulo since 1886. He has published a number of valuable papers on the geology and geography of Brazil, and is considered one of the first authorities on the subject.

**Derby, Conn.,** city in New Haven County, at the junction of the Naugatuck and Housatonic rivers, and on the New York, New Haven & Hartford Railroad; nine miles west of New Haven. In 1893 the towns of Birmingham and Derby were consolidated and incorporated as the city of Derby. It is a manufacturing city of much importance and has abundant water power from the two rivers. There are extensive manufactures of brass and iron goods, paper, pins, and spectacles, and at one time the old town had a large West India trade and noted

ship-building yards. A bridge across the Naugatuck River connects Derby with the thrifty manufacturing city of Ansonia. It has several parks, daily and weekly newspapers, a national bank, good public and private schools. Pop. 7,930.

**Derby, England,** a municipal and parliamentary borough, capital of Derbyshire, on the Derwent River, and the main line of the Midland Railroad, 115 miles north-northwest of London. It has some fine public buildings, among which are the churches of All Saints, St. Alkmund, and St. Werburgh, built before the time of Henry VIII.; St. Mary's (Roman Catholic) designed by Pugin. The Derby public school dates from the time of Queen Mary. There is also a very handsome free library and museum. The principal manufactures are silk, cotton, paper, articles in Derbyshire spar, castings, and porcelain, etc. Derby is one of the oldest towns in the kingdom, and is supposed to owe its origin to a Roman station, *Derventio*, situated at Little Chester, on the opposite side of the river. Under the Danes it took the name of *Deoraby*. Richardson, the novelist, was a native of the town. Pop. (1901) 105,785.

**Derby Day,** the great annual London holiday, on which "The Derby," one of the most popular of the English horse-races, is run. It always falls on a Wednesday, being the second day of the grand race meeting, which takes place in the week after Trinity Sunday. The race is run on Epsom Downs, an extensive plain in the neighborhood of London. This race was instituted by the Earl of Derby in 1780. The entry-money is now \$500, but under the new regulations introduced in 1890 the first prize is definitely fixed at \$25,000 with any surplus fees. The course over which the race is run is a mile and a half in length. Since the race was instituted the weights have been several times increased, until now the colts have to carry nine stone, and the fillies eight stone nine pounds. Derby day is now regarded, especially in London, as a great holiday, and vast multitudes flock from the city and its neighborhood to Epsom Downs. The grand inauguration racing day of the summer season at Washington Park, Chicago, is called the American Derby day.

**Derbyshire,** a county in England, in the interior; area 1,029 square miles. The county is noted more for its coal mining and manufacturing than for agriculture. Its beautiful scenery and the numerous mineral springs attract tourists and health seekers. Its chief minerals are coal, iron ore, lead, fluor or Derbyshire spar, sandstone, limestone, alabaster, marble, zinc, and elastic bitumen. Some of the industries of the county are the manufacture of iron, silk and cotton goods, calico prints, agricultural implements, paper, hats, porcelain, various kinds of cloth, and vases, urns, etc., from the Derbyshire spar. The coal mining is an important industry and to transport the coal several canals and railroads cross the county. The principal towns are Derby, Buxton, and Belper. Pop. 620,196.

**Derbyshire Neck.** See GOITRE.

**Derbyshire Spar,** also called fluorite, and fluor-spar; is abundant in Derbyshire, and also in Cornwall, England. In the north of England it is the gangue of the lead veins which intersect the coal formations in Northumber-



land, Cumberland, Durham, and Yorkshire. It is found of almost every variety of color. The "Blue John" of the Derbyshire miners is a crystalline fluorite in which are alternate bands of blue and pale yellow spar. It is made into ornamental articles such as vases. See FLUORITE.

**Derceto**, dĕr-sĕ'tō, the Greek name of a Syrian goddess, the principal female deity of the Philistines, widely worshipped at Ascalon. She was the female counterpart of Dagon (q.v.), terminating like him in a fish. She was a nature goddess presiding over the principle of generation and fertility.

**Derecske**, dĕ'rĕch-kĕ, Austria-Hungary, a market town in Hungary, in the county of Bihar. In the neighborhood are four lakes, from which, by evaporation, soda is obtained. Nearby is another lake, called Fingoto, celebrated from the earliest times for its baths. In the same locality pearls are found, which, though small, are equal in beauty to those of the East. Pop. 8,272.

**Derelict**, any property abandoned at sea. Especially a ship abandoned by her crew either by consent or by compulsion, stress of weather, or other unforeseen condition, and yet, to save the owner's rights, if any cat, dog, or other domestic animal be found on board alive, it is not forfeited. The owner may yet recover, on payment of salvage, within a year and a day—otherwise the whole may be taken.

**De Reszke**. See RESZKE.

**Derg**, Lough, lōh dĕrg. (1) An expansion of the Shannon River, between the provinces of Munster and Connaught, Ireland. (2) A lake in the southeast of the county of Donegal, province of Ulster, Ireland. Saint's Isle and Station Island are in this lake.

**Derham**, dĕr'am, William, English philosopher and divine: b. Stoughton, near Worcester, 26 Nov. 1657; d. Upminster, Essex, 5 April 1735. He became in 1685 vicar of Wargrave, in Berkshire, and in 1689 rector of Upminster in Essex, where he spent the remainder of his life. Though small in stature, distorted, and of ungainly appearance, he had a highly gifted mind, and not only possessed the universal esteem of his parishioners, but acquired considerable reputation in various departments of literature. His best known works are: 'Physico-Theology'; 'Astro-Theology'; and 'Christo-Theology.'

**Dermat'itis**, a name given to certain inflammations of the skin, characterized not so much according to form and arrangement of the pathological changes taking place in the skin, but rather from their cause. These causes may act from within or without. The characteristic change taking place is some form of erythema or redness, with the characteristic heat, redness, and swelling. Thus there are found dermatitis traumatica, or the dermatitis set up by mechanical injuries such as blows, pressure, friction, scratching; dermatitis calorica, such as is due to sunburn or frostbite; X-ray dermatitis, dermatitis venenata, due to animal, vegetable, or mineral poisons, such as mustard, turpentine, croton-oil, tartar emetic, poison ivy, nettle, aniline dyes, strong acids, strong alkalies, arnica, etc.; dermatitis medicamentosa, or drug eruptions, such as happen following the use of anti-febrin, antipyrin, belladonna, arsenic, bromides,

iodides, etc. There may be also dermatitis following vaccination or following poisoning in wounds. There are other forms too numerous to mention, but those given are the commonest.

**Dermatol'ogy**, (from Gr. *derma*, the skin), a science that treats of skin diseases. See SKIN.

**Dermat'ophyte**, a parasitic plant, a sort of fungus infesting the cuticle and epidermis of men and animals, and giving rise to various forms of skin disease. The commonly known species are *Achorion Schanleini* (favus); *Trichophyton tonsurans* (ringworm); and *Microsporon furfur* (dandruff, scurf).

**Dermestes**, dĕr-mĕs'tĕz, a genus of coleopterous insects, the type of the family *Dermestidae*. The larvæ of this genus are covered with slippery hairs. They devour dead bodies, skins, leather, and other animal substances. One species (*D. lardarius*) is known by the name of bacon-beetle, and is often found in ill-kept ham or pork shops. Many insects, the larvæ of which have similar habits to those of the true *Dermestes*, sometimes receive that name, although they really belong to the genera *Attagenus*, *Necrophorus*, etc.

**Der'mot Mac Mur'ragh**, Irish king; the last ruler of Leinster, before the sovereignty was assumed by Strongbow, in the reign of Henry II. of England. He became king of Leinster in 1140, and having carried off the wife of O'Ruarc, Prince of Leitrim, was attacked by the latter, and was driven from Ireland in 1167. He betook himself to Aquitaine, where he did homage to the English king, who granted him permission to enlist adventurers in England, to aid him in recovering his kingdom. He received the aid of Richard de Clare, Earl of Pembroke, usually called Strongbow, who married his daughter Eva in 1170. With his aid he proved victorious, but when he died in the same year his kingdom was assumed by his son-in-law.

**Dernburg**, Friedrich, frĕd'rĭh dĕrn'boorg, German journalist and descriptive writer: b. Mentz 3 Oct. 1833. After a university course he rapidly acquired eminence in journalism and politics, and was a well-known correspondent at the Chicago Columbian Exposition. 'From the White City' (1893), a series of World's Fair sketches; 'In the Bonds of Guilt' (1894); and 'The Over Proud' (1889), are typical specimens of his fact and fiction.

**Derne**, dĕrn, or **Derna**, Africa, a town of Tripoli, in Barca, on the north coast of Africa, in a fertile district. It was captured by the United States fleet in 1815 during the war against Tripoli. Pop. 6,000. See DERNE EXPEDITION.

**Derne Expedition** (Derna or Dern), an expedition undertaken during the first years of the 19th century by William Eaton, an American who had been United States consul to Tunis in 1799-1803. Eaton became indignant at the abject submission of Christendom, part from fear and part from greed, to the wretched Barbary pirates; he had raged at their insults year after year while he was consul at Tunis; and when Tripoli, in 1801, finally insisted on war despite all payments, eagerly seized the chance of ending its robberies once for all by making it a United States protectorate. About 1792



Hamet Caramanli or Caramelli, pasha of Tripoli, had been deposed by his brother Yusuf and fled to Tunis, where he was then living; and Eaton resolved to have the United States restore him on condition of peace and no tribute, and thus striking terror into the other piratical states. He borrowed \$22,000 for Hamet to equip a force, with which our navy was to co-operate; but the naval commanders' hands were tied by their instructions, and in 1803 Eaton's plain-spoken refusal to comply with the bey's extortions caused his peremptory dismissal as consul. He returned to the United States and urged Jefferson to make the country a United States protectorate, but the government could not give *carte blanche* for so daring a scheme to the fiery dreamer. At length, in March 1804, Eaton was sent to the Mediterranean as "naval agent" with Barron's squadron, but without authority or instructions. He cared for neither squadron nor authority if he could have help and be let alone. Meantime Hamet Caramanli had failed and fled to Egypt, where, when Eaton arrived at Cairo on 8 December (having heard at Malta, in September, of Hamet's fiasco), the viceroy was besieging him and a few followers at Minyeh on the Nile. Eaton rescued him at great pains and some peril, and brought him to Alexandria; made a pact with him and a plan of campaign with Barron; and collected an "army" of some 500 floaters,—the majority Arabs, some Tripolitan Kabyles, a hundred Alexandrian Christian Greeks and Americans, a most extraordinary rabble for a desperate military venture,—and started for a march of 600 miles across the Libyan Desert to Derne, the seaport capital of Barca, the most fertile province of Tripoli. They had no provisions but what they carried, and no water for days together; and more than once the Arabs with Hamet were on the point of deserting in a body or cutting Eaton's throat. His energy and moral force finally pulled the entire body through a six weeks' march to Bomba, just east of Derne, 17 April 1805; but no ships were in sight. The Arabs cursed him afresh as an infidel traitor, and resolved to break up next morning; Eaton and the Christians took post on a hill for the night and lit fires, and next morning the waiting fleet saw the smoke and came in. The Arabs rejoined them, and after restocking from the fleet, and resting a week, on the 25th, in co-operation with three cruisers, they assailed Derne, defended by earthworks and 800 men. On the 27th they carried it by storm, Eaton being shot through the wrist. A large force was sent from Tripoli to retake it; and on 13 May he repulsed it in a sharp engagement with the aid of the fleet's guns. Another month passed; Derne showed no enthusiasm over Hamet, one Oriental master being about the same as another; Eaton could not march on Tripoli, some 700 miles farther on, but the pasha's troops could not drive him from Derne. Suddenly the ground was cut from under his feet by Lear's astounding treaty with the pasha, defensible as a treaty, but in its terms most incomprehensible and indecent. Hamet's supporters were left to the pasha's vengeance, Hamet to European exile and a grudging pension, and Hamet's family in the possession of the pasha. As to Eaton, he was left to useless political agitation, idle energies, and drink. See BARRARY POWERS, UNITED STATES TREATIES AND WARS WITH THE.

**Derosne, Charles**, shārl dè-rôn, French chemist and inventor: b. Paris 1780; d. there September 1846. He devised a still for the rectification of alcohol so arranged that instead of the weaker aqueous spirit which distilled being completely condensed by cold water, it was condensed by water only a little under the boiling-point of the mixture, so that while the alcohol still remained as vapor, a large proportion of the watery vapor was condensed, and thus the distillate was made stronger. This apparatus is called by his name. His most important research was into the composition of opium, in the course of which he isolated a crystalline body, long distinguished as Derosne's salt. He himself did not determine its character, and it was not till some years later that it was distinguished as an alkaloid by Robiquet, and called by him narcotin, the name by which it is now known. He was the first to introduce animal charcoal for decolorizing syrup.

**De Rosny, Léon**, lā-ōh dè rō-nē, French Orientalist: b. Loos, France, 5 Aug. 1837. He became professor of Japanese at the Special School of Languages in 1868, and founder of the International Congress of Orientalists. Among his numerous works are: 'Asiatic Studies' (1864); 'The Origin of Language' (1869); 'Japanese Anthology' (1871); 'A Grammar of the Chinese Language' (London 1874); 'Japanese Religion' (1881); and various translations, pamphlets, and essays.

**Déroulède, Paul**, pol dā-roo-lād, French poet: b. Paris 2 Sept. 1846. His 'Soldier Songs' (1872) and 'Military Refrains' (1888) were immensely popular, and won him the presidency of the Patriotic League; an association intensely hostile to Germans, and whose agitation seemed likely to lead to a collision with Germany, wherefore the poet was prevailed on to retire from the presidency. He has written a drama on patriotism, 'The Hetman,' and the semi-religious drama, 'The Moabitess.'

**Derrick.** See HOISTING APPARATUS.

**De Russy, René Edward**, American military officer: b. in Haiti, W. I., 22 Feb. 1789; d. San Francisco 23 Nov. 1865. He was graduated at the United States Military Academy in 1812, serving with credit in the war with England. He subsequently supervised the construction of fortifications in New York harbor and the Gulf of Mexico. During the Civil War he was ordered to the Pacific coast, where he constructed defenses in San Francisco harbor.

**Dervish, or Dervis** (Per. "poor"), the name of a class of religious devotees of the Mohammedan faith, all leading a life of poverty, and generally practising mendicancy. The observance of strict forms, fasting, and acts of piety, give them a character of sanctity among the people. They live partly in monasteries, partly alone, and from their number the imams are generally chosen. Throughout Turkey they are freely received, even at the tables of persons of the highest rank. There are, throughout Asia, multitudes of these devotees, monastic and ascetic, not only among the Mohammedans, but also among the followers of Brahma. There are 32 religious orders now existing in the Turkish empire, many of which are scarcely known beyond its limits: but others, such as the Nakshbendies and Mevlevies, are common in

Persia and India. All these communities are properly stationary, though some of them send out a portion of their members to collect alms. The regularly itinerant dervishes in Turkey are all foreigners or outcasts, expelled from their orders for misconduct. All these orders, except the Nakhshbandies, are considered as living in seclusion from the world; but that order is entirely composed of persons who, without quitting the world, bind themselves to a strict observance of certain forms of devotion, and meet once a week to perform them together. Each order has its peculiar statutes, exercises, and habits.

The numerous orders of dervishes are all divided into two great classes, the dancing and the howling dervishes. The former are the Mevlevies, and are held in much higher estimation than the other class. They are the wealthiest of all the religious bodies of the Turkish empire. The dancing of these dervishes is conducted to sounds of music. The movement at first is slow, but as the dervishes become excited it grows in animation, until at last the actors are exhausted, and are obliged to sit down. After a while they rise up again and resume their dancing, which is repeated several times. The whole is concluded by a sermon. The howling dervishes accompany their dancing with loud vociferations of the name of Allah, and violent contortions of the body such as are seen in persons seized with epileptic fits. In former times these dervishes, after working themselves up into a frenzy, used to cut and torture themselves in various ways with apparent delight. The sheiks of all orders have the credit of possessing miraculous powers. The interpretation of dreams, the cure of diseases, and the removal of barrenness, are the gifts for which the dervishes are most in repute. See **FAKIR**.

**Derwent**, dĕr'wĕnt, (1) the name of four rivers in England, in Derbyshire, Yorkshire, Durham, and Cumberland respectively. The Yorkshire Derwent is a tributary of the Ouse. (2) A river in Tasmania. It expands into an estuary where it enters the South Pacific Ocean. A lighthouse, elevated 70 feet above the sea, has been erected on Iron Pot Island, at the entrance of the Derwent, exhibiting a fixed light, visible at from 12 to 15 miles' distance. On the Derwent estuary is the town of Hobart.

**Der'wentwater**, James Ratcliffe, EARL OF, English nobleman: b. London 28 June 1689; d. London 24 Feb. 1716. His grandfather had been created Earl of Derwentwater by James II., and his father, Francis, married a natural daughter of Charles II. He succeeded to the title in 1705 and entertained a personal attachment toward the Stuart family, which induced him to take part in the attempt to restore them to the English throne. The standard of revolt having been raised in Scotland, Lord Derwentwater commenced the movement in England on 6 Oct. 1715. The cause of the Pretender was a losing one from the first, and in spite of the energy and courage displayed by the Earl of Derwentwater and other Jacobite nobles, they were compelled to surrender at discretion at Preston on 13 Nov. 1715. The Earl of Derwentwater, being impeached for high treason, pleaded guilty, and was beheaded on Tower Hill. His estates were confiscated and given to Greenwich Hospital.

**Derwentwater**, or **Keswick Lake**, a beautiful lake in Cumberland, England, in the vale of Keswick. It is about three miles in length and one and a half in breadth, and stretches from Skiddaw on the north to the hills of Borrowdale. Near the northeast corner is the celebrated cascade of Lodore. Its waters are carried to the sea by the Derwent.

**Derzhavin**, dyĕr-zhă'vĕn, Gab'riel Roma'novitch, Russian lyric poet: b. Kasan 14 July 1743; d. Novgorod 6 July 1816. In 1793 he was called to the senate, in 1800 was master of the imperial treasury, and in 1802 was minister of justice. The year following he was permitted to retire on full pay. His poetic talent had become early developed, and he is generally allowed to hold the first place among the poets who appeared during the reign of Catharine. He was an enthusiastic admirer of this empress, and has celebrated her in his most brilliant odes. Of these, however, at once the most beautiful and the best-known is his 'Oda Bog,' or 'Address to the Deity,' which, for sublimity both of thought and expression, has seldom been surpassed, and has been translated into most European languages. Almost all his poems are rich in true poetic beauties, though occasionally he indulges too much in gaudy Oriental metaphor. His works, containing, in addition to the Odes, several dramatic pieces and prose writings, were published at St. Petersburg 1810-15.

**Desaguadero**, dă-să-gwă-thă'rō, a valley in Bolivia and Peru, between two ridges of the Andes into which the great chain divides, near the city of Potosi. This valley or table-land is about 400 miles in length, and varies from 30 to 80 miles in breadth; area 150,000 square miles, and includes Lake Titicaca, and the smaller lake Aullagas or Uros. Desaguadero signifies in Spanish "a channel."

**Desaguadero River**, Bolivia, (1) the outlet for the waters of Lake Titicaca. It is 280 miles in length, running from Lake Titicaca southward to Lake Poopó or Agullas, in the département of Oruro. The lake last mentioned is without any known outlet. For many years traffic on this river has been hampered, the Lake Titicaca steamers running only as far as the town of Desaguadero (the head of navigation, pending improvements, for boats of considerable size), while beyond that town smaller steamers, engaged in carrying the silver and tin ores of Oruro and the copper of Corocoro, descended to a point 40 miles farther down the stream. A concession for canalizing the Desaguadero so as to extend navigation about 200 miles farther south was granted by the Bolivian government to a Peruvian corporation in 1892. Moreover a railroad from the northern shore of Lake Titicaca to Cuzco was projected, and has been partly built. These works, when completed, will form a system of land and water transportation unique in all the world; approximately 500 miles in length, and at an altitude ranging between 11,000 and 13,000 feet above the level of the sea, connecting the historic Cuzco (the ancient Inca capital) and the extensive silver and lead districts of Totalaya on the north, with the mines of Corocoro and Oruro. (2) A river called Desaguadero is in Argentina, and flows into Lake Bevedero Grande and separates the provinces of San Juan and Mendoza.

**Desaix de Veygoux, Louis Charles Antoine**, loo-ē shārl ān twān dē-sā dē vā-goo, French general: b. St. Hilaire-d'Ayat, Auvergne, 17 Aug. 1768; d. Marengo 14 June 1800. Entering the army at 15, in 1796 he covered himself with glory by his heroic conduct in Moreau's famous retreat through the Black Forest. Behind the ruinous fortress of Kehl, Desaix resisted the Austrian army for more than two months, only capitulating in January 1797, when his ammunition was spent. His greatest achievement was the conquest of Upper Egypt, accomplished in 1799, after an eight months' campaign. His own soldiers used to compare him to Bayard, while the inhabitants named him "the Just Sultan." Desaix returned from Egypt just in time to take part in the battle of Marengo, in which he was killed.

**Desātir**, the name given to a collection of sacred books, purporting to be the work of the 15 old Persian prophets, together with a book of Zoroaster. The collection is written in a language no longer spoken and equally different from the Zend, the Pehlvi, and modern Persian. The last of the 15 prophets, Sasan, who lived at the time of the downfall of the Sassanides, literally translated the Desātir, and accompanied it with commentaries. This work was until the 17th century one of the chief sources of the ancient Persian religious doctrines, interwoven with astrology and demonology; and, after having been forgotten for about a century and a half, was discovered at Ispahan and published at Bombay in 1818. Erskine added an English translation, but considered the collection as spurious; and Sylvester de Sacy believed it the work of a Parsee in the 4th century of the Hégira, who invented the language. By some, however, it is considered as genuine. No trace of any connection with the Zendavesta and the magic of the Parsees has been found in the Desātir.

**Désaugiers, Marc Antoine Madeleine**, mārċ ān-twān mād-lēn dā-zo-zhē-ā, French song writer and dramatist: b. Frèjus 17 Nov. 1772; d. Paris 9 Aug. 1827. His life till 1797 was full of adventure; he was at one time a prisoner of the revolted blacks in San Domingo and in momentary fear of death. Going on the stage in Paris in 1805, his parody of the opera 'Danaïds' ("The Little Danaïds") was acted for 300 consecutive nights. His vaudevilles were remarkably successful. As a light song writer he is second only, if indeed second, to Béranger. Many of his songs will live long; such as 'The Consolations of Old Age,' 'The Picture of New Year's,' 'The Market'; 'Sunday Pleasures'; 'The Palais Royal.'

**Desault, Pierre Joseph**, pē-ār zhō-zēf dē-zō, French surgeon: b. Magny-Vernais 6 Feb. 1744; d. Paris 1 June 1795. He went to Paris in 1764, and was one of the numerous scholars of the celebrated Petit. He soon became celebrated by introducing a new method of teaching anatomy. While lecturing on the parts of the human body, he treated of the diseases incident to each. After having been several years principal surgeon of the hospital De la Charité, where he increased his reputation by introducing new methods of treatment, or by improving and simplifying those already in use, he was put at the head of the great Hôtel-Dieu, in Paris, in 1788. Here he founded a surgical school, in

which have been educated many of the most eminent surgeons of Europe. His principal merits were, that he brought accuracy and method into the study of surgery; improved the treatment of fractured bones, by adopting improved bandages; first introduced into France the clinical method of instruction in surgery; and infused into his scholars a generous attachment for their profession. He was distinguished for the skill and boldness with which he performed operations. Desault wrote only two small treatises; but the 'Journal de Chirurgie,' in which his scholars published his lectures delivered in the Hôtel Dieu, and the 'Œuvres Chirurgicales,' edited by Bichat under Desault's name, contain his whole system.

**Desbarres, dā-bār', Joseph Frederick Wallet**, English military engineer: b. England 1722; d. Halifax, N. S., 24 Oct. 1824. In 1756 he sailed as lieutenant for America, where he raised, and for a time commanded, a corps of field artillery. In 1757 he gained a victory over the Indians who had captured Fort Schenectady; and at the siege of Quebec was aide-de-camp to Wolfe, who was mortally wounded while Desbarres was making a report. He conducted the subsequent engineering operations during the conquest of Canada, and was quartermaster-general in the expedition that retook Newfoundland (1762). He made a survey of the coast of Nova Scotia in 1763-73, and afterward prepared charts of the North American coast for Lord Howe. He was lieutenant-governor of Cape Breton (1784-1804), and of Prince Edward Island (1805-13).

**Descartes, René**, rē nā dā-kārt (Latinized Renatus Cartesius), French philosopher: b. La Haye, Touraine, 31 March 1596; d. Stockholm 11 Feb. 1650. He was educated in the Jesuits' school at La Flèche. Both his birth and inclination led him to embrace the military profession, and he served in Holland under Prince Maurice, and in Bavaria under the Duke of Bavaria, and was present at the battle of Prague in 1620. He left the army in 1621, and visited Moravia, Silesia, Poland, Pomerania, and the shores of the Baltic. After a variety of travels he remained in Holland, where he composed most of his writings from 1629 to 1649, drew about him many scholars, and was engaged in many learned controversies, especially with theologians.

His celebrated system abounds in singularities and originalities; but a spirit of independent thought prevails throughout it, and has contributed to excite the same spirit in others. It has done much to give to philosophical inquiries a new direction, and found many adherents, especially in England, France, and Germany. Descartes, seeing the errors and inconsistencies in which other philosophers had involved themselves, determined to build up a system anew for himself, divesting himself first of all the beliefs he had acquired by education or otherwise, and resolving to accept as true only what could stand the test of reason. Proceeding in this way he found that there was one thing that he could not doubt or divest himself of—the belief of, and that was the existence of himself as a thinking being, and this ultimate certainty he expressed in the celebrated phrase "*Cogito, ergo sum*" (I think, therefore I am). Here, then, he believed he had found the test of truth.

## DESCARTES' RULE OF SIGNS — DESCENT IN LAW

Whatever he saw to be true with as much certainty as he felt the certainty of his own existence was to be accepted as worthy of belief, and whatever could not stand that test was to be rejected.

Starting then from the indubitable reality of a thinking being, Descartes further says that this thinking being, that is to say, the soul, evidently differs from the body, whose existence consists in space or extension, by its simplicity and immateriality (whence, also, its immortality), and by the freedom that pertains to it. But every perception of the soul is not clear and distinct; it is in a great degree involved in doubt, and is so far an imperfect, finite being. This imperfection of its own leads it to the idea of an absolutely perfect being. (He therefore here makes use of the so-called ontological proof of the existence of God in a different manner from that in which Anselm of Canterbury had formerly employed the same; and hence the name of the "Cartesian proof.") He placed at the head of his system the idea of an absolutely perfect being, which he considers as an innate idea, and deduces from it all further knowledge of truth. The principal problems of metaphysics he conceived to be substantiality and causality. He contributed greatly to the advancement of mathematics and physics. He made use of the discoveries and observations of others, defining them accurately, and assigning them their place in his system. The higher departments of geometry (to which he successfully applied analysis), as well as optics, dioptrics, and mechanics, were greatly extended by him, their method simplified, and thereby the way prepared for the great discoveries made in the sciences by Newton and Leibnitz; for instance, he contributed much to define and illustrate the true law of refraction. His system of the universe attracted great attention in his time, but has been long since exploded. It rests on the strange hypothesis of the heavenly vortices, immense currents of ethereal matter, with which space is filled, and by which he accounted for the motion of the planets. He labored much to extend the Copernican system of astronomy.

Descartes loved independence; he nevertheless suffered himself to be persuaded to go to Stockholm, upon the invitation of Queen Christina, but died at that place four months after his arrival. His system is set forth in the treatise '*Discours de la méthode pour bien conduire sa raison et chercher la vérité dans les sciences*' (1637) with its appendices, '*La dioptrique*'; '*Les météores*'; and '*La géométrie*.' An edition of his works by Victor Cousin was published in 11 volumes (1824-6). A judicious selection from his philosophical writings, accompanied by an introduction, has been published by Jules Simon (1865). See Kuno Fischer, '*History of Modern Philosophy*'; Mahaffey, '*Descartes*' (1880); Fouille, '*Descartes*' (1893).

**Descartes' Rule of Signs** is a theorem by which the maximum number of positive or negative roots of an equation can at once be detected on sight. The theorem may be thus explicated: The number of positive roots of an equation cannot exceed the number of variations in the signs of its coefficients, considered in their proper order. A fair example is the cubic equation:  $F(x) = 3x^3 - 7x^2 + 11x + 4 = 0$ . Here are but two variations of signs on passing from one extreme term to the other, through the in-

termediate ones; we conclude therefore that the cubic can not have more than two positive roots. The maximum number of negative roots is seen on applying the same theorem to the equation which obtained from the original by changing  $x$  into  $-x$ . Thus the positive roots  $F(-x) = -3x^3 - 7x^2 - 11x + 4 = 0$  are negative roots of the original cubic, and by Descartes' rule cannot exceed one.

**Descendants**, as a term of law, is applied to the issue of a person, or the offspring of such issue, to the farthest generation. Such descendants have a prior claim over collateral relatives or ascendants in the inheritance of property left by a deceased ancestor.

**Descent in Law** is the transmission of the real estate of a person dying intestate to his heir or heirs. The title acquired by the heir, in this manner, is called title by descent.

Prior to the Revolution, the law in England was that real estate could only descend and never ascend; but in the United States the law has been changed by statute, and at the present time real estate may ascend as well as descend; but, as far as the title is concerned, it is called title by descent.

According to the old English law, real estate descended to the oldest son who was living; provided that he had no elder brother who had died leaving a son to survive him; if all the sons had died without leaving issue, all of the daughters inherited together. There were exceptions to this rule, as in one part of England, the youngest child was the heir. Estates tail might also be called an exception, in some cases, as an estate tail female, where the daughter took the property; and if there were no daughters, the estate went to a person outside of that immediate family, the sons being excluded absolutely. In the United States, some of the States have passed laws by which any words used, in the granting of an estate, which would create an estate tail, shall be considered as creating an estate in fee simple, and by this means have abolished estates tail.

The rules of descent are applicable only to real estate, although sometimes they are incorrectly spoken of as applying to personal property also. Distribution is the proper word to use in speaking of personal property.

In some of the States, the laws of descent and distribution are practically the same; while in other States there is a great distinction between the laws of descent and those of distribution. The laws of descent and distribution are regulated by statutes in the different States, and may be changed at any time. Inasmuch as the laws of only a few of the States are the same and consequently a great many of them identically similar, it is necessary to examine the statutes of any particular State to find out what the law is in that particular State.

The general rule in the United States seems to be, that real estate descends to children, grandchildren and on down in the lineal line; in default of these heirs, then to parents, and, if they are dead, the estate goes to collaterals; and if there are no heirs to the State. The law of the place where the real estate is situated is the law according to which the estate passes to the heir; and it makes no difference where the decedent was domiciled.

## DESCENT OF MAN — DESERT

**Descent of Man and Selection in Relation to Sex**, *The*, a work by Charles Darwin, published in 1871. The evidences of the descent of man from some earlier, less-developed form, collected and marshaled by Darwin, consist of minute inferential proofs of similarity of structure, at certain stages of development, between man and the lower animals. This similarity is especially marked in the embryonic stages; and taken with the existence in man of various rudimentary organs, seems to imply that he and the lower animals come from a common ancestor. Darwin reasons that the early ancestors of man must have been more or less monkey-like animals of the great anthropoid group, and related to the progenitors of the orang-outang, the chimpanzee, and the gorilla, and that still remoter ancestors must have been aquatic. The 'Descent of Man' was received with enthusiasm by scientific men, and its influence was much greater than that of the 'Origin of Species.' It had an effect not merely on physical and biological science, but on ethical and religious conceptions. In the volumes containing the 'Descent of Man' Darwin placed his elaborate treatise on sexual selection, which may be regarded as a part of the theory of man's descent. See DARWINIAN THEORY.

**Deschamps, Eustache**, ès-tāsh dā-shān, called MOREL, French poet: b. Vertus, Marne, about 1330; d. after 1475. He composed a multitude of short poems of a political or moral nature. The 'Mirror of Marriage' comprises 13,000 lines. He wrote an 'Art of Poetizing,' the earliest work of its kind.

**Descroizilles, François Antoine Henri**, frān-swā ān-twān ōn-rē dā-krwā-zēl, French chemist: b. Dieppe, 11 June 1751; d. Paris, 14 April 1825. He studied chemistry at Paris under Rouelle, and thereafter became professor at Rouen. He especially devoted himself to the technical applications of the science. Berthollet had hardly discovered bleaching by chlorine, when Descroizilles tried it at his works at Les-cure-lez-Rouen, and found that it succeeded. He collected the chlorine in water containing chalk, and thus made a step at a very early period in the direction of bleaching-powder. In the course of his operations he contrived different pieces of apparatus for the rapid valuation of commercial products. Thus his alkalimetre for the estimation of alkalies by Vauquelin's method, his apparatus for estimating vinegar (aceti-metre), and for bleaching liquid (Bertholli-metre), are among the earliest contributions to volumetric analysis. He also contrived a still for the estimation of alcohol in wine. He published a great many researches, especially on technical chemistry. He was the first to show that alum is a double salt.

**Desdemo'na**, the heroine of Shakespeare's tragedy 'Othello.' She is the daughter of a Venetian senator, Brabantio, and is drawn to love the Moor who visits her father, by hearing him relate the vicissitudes of his adventurous career. She marries him against her father's will and proves a devoted wife, but Othello, through the machinations of Iago, is led to doubt her fidelity, and, in a jealous rage, smothers her. Desdemo'na's character is marked by modesty, sweetness and innocent trustfulness. See OTHELLO.

**Desecada**, dēs-ē-ā-dā. See DÉSIRADE.

**Deseret**, dōz'ēr-ēt, the name first adopted by the Mormons for what is now Utah. See MORMONS; UTAH.

**Deseronto**, dōz-ēr-ōn'tō, Canada, a town in Hastings County, province of Quebec; on the Bay of Quinte, the Grand T. and the Canadian P. R.R.'s. It is about 132 miles west of Toronto. Its principal manufactures are lumber-mills, agricultural machinery, flour, and furniture. The gas used for illumination is made from the sawdust of the lumber-mills. Pop. 3,609.

**Desert** (literally, "a solitary place"), a term designating in its broadest application any uninhabited region, this being the sense in which it is frequently found in the Scriptures. In its more ordinary use the word means a portion of the earth's surface that on account of its barrenness cannot support inhabitants. Four classes of desert may be distinguished: (1) Ice-wastes occupy the central plateau of Greenland, the islands of the Arctic Sea, and probably the entire Antarctic continent. (2) Tundras (q.v.) are flat plains, little elevated above sea-level, fringing the Arctic shores of the northern continents, and especially characteristic of Siberia. (3) Temporary deserts, or steppe-lands, border the Asiatic deserts to the north and west. The saline steppes of the Caspian are true arid wastes; but the typical steppes in South Russia are luxuriantly clothed with verdure and flowers in spring. In the dry season they form a dusty plain of withered herbage. The llanos (q.v.) of the Orinoco have similar characteristics, but the pampas of South America include portions perennially green and suitable for agriculture. (4) Arid wastes, or deserts in the popular sense of the word, occur mainly in two zones encircling the world, and corresponding to regions of minimum rainfall. The greater zone extends from near the equator in an east-northeast direction across the whole breadth of North Africa, as the Great Sahara, Libyan and Nubian deserts, over the peninsula of Arabia, through Persia, Turkestan, and the vast tracts of Gobi or Shamo to the confines of China. The sandy zone, thus traced throughout the breadth of the ancient continent from western Africa to lon. 120° E., has been computed to cover an area of 6,500,000 square miles; but the Asiatic portion of this tract includes many chains of mountains, and fertile valleys. The great Indian Desert in the Punjab is the only extension of this belt south of the Himalayas. The ring is completed by the Great Basin of North America in lat. 40° N. The southern zone, less complete, comprises the Kalahari Desert in southwest Africa, the interior of Australia, and districts in Chile and in the Argentine Republic.

Deserts occur at all elevations, from considerable depths beneath sea-level to many thousand feet above it, and with all varieties of surface, from a flat expanse of sand, where the view for days of travel is bounded by a sharp circle as at sea, to rocky mountain slopes rent by rough defiles bare and chiseled by the driving sand. The essential character of an arid waste is its rainlessness, and the scarcity of water on the surface and of water vapor in the atmosphere. Radiation in the clear air is rapid and desert climate is consequently of an exaggerated continental type. The sand in the Sahara becomes heated to over 150° F. during the day, and



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chilled below the freezing point at night, while the diurnal and seasonal extremes in the lofty deserts of Central Asia are much greater. Thus desert-regions are most effective in producing land and sea breezes and monsoon winds in consequence of the marked periodical changes in atmospheric density. Another effect is the mirage (q.v.), a phenomenon which, combined with the great loneliness that oppresses the occasional traveler, probably accounts for the widespread superstitions peopling deserts, above all other places, with evil and malicious spirits. The dreaded sand-storm or simoom is a kind of tornado or whirlwind which raises the sand in tall rotating columns sweeping over the surface with tremendous velocity. Sand-dunes, sometimes several hundred feet in height, are raised by steady winds, and gradually shift their position. Desert vegetation is extremely scanty, consisting mainly of hard prickly plants of the cactus, euphorbia, and spinose kinds, whose surface exhales little moisture. Animal life is correspondingly restricted both in variety and number of individuals. The camel is *par excellence* the beast of burden for conducting traffic across arid wastes. When an overflowing river, such as the Nile, traverses a desert, the land becomes richly fertile in its immediate neighborhood, and wherever springs bubble up through the sand there are oases, bearing palm-trees and grass. Artificial irrigation, especially the sinking of artesian wells, has done much to reclaim tracts of desert for agriculture in the Sahara and to a less extent in Australia, while the area of arid land in the western part of the United States, once considered irreclaimable, is being rendered by irrigation increasingly productive.

Geological considerations show that arid deserts are not permanent features of the earth's surface. The most level expanses have once formed part of the ocean bed, or at least great inland seas. The orographical changes which cut off these seas and created inland drainage areas probably at the same time modified the rainfall of the locality. Excessive evaporation dried up the great lakes, leaving at present a series of diminishing salt lakes without outlet, receiving rivers which dwindle down by evaporation as they flow. The only commercial commodities yielded by deserts are the salts (common salt (borax, sodium carbonate, and sometimes sodium nitrate) left in the dried-up lake beds. These salt lakes are subject to alternate long periods of desiccation and flooding; during the former the area of the desert extends, during the latter it contracts. These periods have been traced out in the case of the Great American Basin by a series of most interesting researches on the part of the United States Geological Survey. See GOBI; SAHARA.

**Desert, The Great American.** The North American deserts possess all the physiographic, geologic and climatic elements which distinguish the African desert of Sahara. The chief difference between the two regions is the relatively larger area of the Sahara, the arrangement of the topographic units and the occurrence in the Great American Desert of a wealth of mineral resources which the Sahara does not possess. Through the application of modern mechanical agencies by American energies and brain, its wastes have become inhabited by an intelligent and progressive people, and its arid hills and

plains made to yield a wealth twice as much per capita as that of any other portion of the United States.

The North American Cordilleran region embraces the whole of our continent between the Great Plains and the Pacific north of the Isthmus of Tehuantepec. Of the grander scenery of the world none is more varied and beautiful than that of this region. From its northern end in far-away Alaska to the jump-off of the Mexican Plateau of the South it presents a marvelous panorama of form, color and sculpture. A few of these features are familiar by name, but the glories of the Cordilleras as a whole have not been written, for even the professional geographer has but an incomplete idea of the region as an entirety, or of its parts and their relations. In fact, much of the Cordilleran region is still so poorly mapped, that there is not yet a chart that gives a correct presentation of its great mountains and valleys. Most people, therefore, have but vague ideas of the Rocky Mountains, the Great Deserts, the western and eastern Sierra Madre, the California sierras, and the Coast ranges—any one of which is as extensive and unique a geographic unit as the great Appalachian region.

The Cordilleran region is likewise one of contrasting extremes. Within it are found every condition of climate, altitude, vegetation and productivity. The rainfall varies from the greatest in the United States (in Washington) to the least in the world (in the Death Valley and the Yuma Desert). Its altitudes range from the highest peaks on our continent (over 17,000 feet) to depressions 300 feet below sea-level. Its vegetation presents the contrast of forests of the largest and most beautiful trees in the world and vast stretches of desert plain with the feeblest mantle of struggling bush and thorn. The region is the motherland of our longest rivers, the Missouri, the Columbia, the Colorado and the Rio Grande; yet it has a million square miles without as much running surface water as the smallest New England township. It has in places mines which yield from a single acre more wealth than whole counties in many Eastern States, and it produces every mineral of the United States; yet again there are hundreds of miles of barren malpais as worthless as any ground the sun shines on. Some of its acres of agricultural soil are the most productive on earth, yielding under intensified and scientific culture the finest and most abundant crops of fruit, grain and tubers; and upon others even the cactus will not grow.

The forested Cordilleras occur in several distinct groups, which are so aligned as to constitute marginal chains of mountains bordering the Eastern and Pacific sides of the Cordilleran region, between which lie the deserts and plateaus. The chief of these groups are, (1) the Montana and Colorado groups of New Mexico, and the eastern Sierra Madre of Mexico, forming the eastern ranges of the Cordilleran region; and (2) the Sierra Nevada, Cascade and Coast ranges of the extreme western United States, and the western Sierra Madre of Mexico, constituting the Pacific or western ranges.

The remainder of the Cordilleran region, including the vast stretches lying between the Sierra Nevada of California and the eastern Cordilleran ranges (Rocky Mountains) in the United States, and between the Pacific Ocean



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and the eastern Sierra Madre of Mexico, constitutes the Great American Desert.

Of the total area of the Cordilleran province, three eighths are forested mountains, one eighth plateau, and one half waterless, treeless, turfless mountain and valley desert. The deserts occur in Nevada, Utah, eastern and southern California, Arizona, New Mexico, and all of Texas west of the Pecos, 550,000 square miles. The American Desert is international, however, for in addition to the above area within the United States, it continues southward into Mexico, where it includes most of the states of Sonora, Chihuahua, Coahuila, San Luis Potosi and Sinaloa—another 500,000 square miles—making a total of 1,050,000 square miles which, although one third the area, is as truly a desert in every natural sense as is the Sahara, which embraces an area of 3,500,000 square miles, and has a population of 2,500,000 people.

Through the area mentioned, the Great American Desert stretches southward far into the tropics, a marvelous country, unique in every feature of landscape and vegetation.

In its entirety (with a few exceptional forested summits) this desert province is one of barren, stony mountain ranges, separated by equally barren stretches of desert plain, an aggregation of elongated arid plains and lower mountain ranges, which mostly follow the axial line of the Cordilleras. The individual deserts have many names, and each differs from the others in some minor aspect.

From a technical point of view a desert in its ultimate analysis is a region in which the rainfall is insufficient to produce run-off. The light rainfall, striking the heated rock surfaces and sandy soils, is soon evaporated or drunk in; even the large bodies of water which may start down the mountain sides as roaring torrents usually die out at the margins of the plains. These waters are highly charged with mineral salts derived from the heated rock surfaces, and these salts are readily redeposited upon the surface or in the interstices of the permeable sands. The torrents locally transport the rock debris—boulders, pebbles, and powder—from one locality to another, but only for short distances; and hence the desert plains are usually composed of the debris of the adjacent mountains, which in more humid regions of ample run-off would have been carried to the sea. The expansion and contraction from the daily temperature causes the desert rocks to fracture *in situ* into the desert waste. This is distributed by wind and torrent, and hence the features of the desert are largely air-made as well as water-wrought.

The scarcity of moisture results in the absence of vegetation of the root-twining, soil-gathering, and soil-making type that distinguishes the humid region. Every plant and species attests the aridity of the country. Exactly as in the Sahara, these plants are thorny, coriaceous bushes and shrubs of the cactus, aloe, and acacia families, adapted to withstand their droughty environment, and to defend themselves from attack by man or beast.

Physiographically there are two sub-provinces of the Great American Desert, lying to the east and to the west of the western Sierra Madre and Colorado Plateau respectively. The westernmost of these may be termed the Nevadan and the eastern the Chihuahuan. The western,

or Nevadan, Desert occupies much of the area of Utah, Nevada, Mexico, southern and eastern California in the United States, and the states of Sonora and Sinaloa in Mexico. The Chihuahuan Desert occupies the vast area of country lying between the eastern and western Sierra Madre of Mexico and their northern continuation into southern New Mexico and Texas west of the Pecos, and is the so-called Mexican Plateau.

The Great Basin Desert is marked by wide flatness, and is largely a region of ancient lake beds. Its surfaces are in many instances what the geologists term constructional, and its flora is mostly sage brush and grease wood; its agricultural products cereals and tubers; and its minerals gold, silver, and copper. The Sonoran Desert is of a more complicated geological type, and instead of being land-locked is bordered on one side by the Pacific Ocean. Some of its surfaces are also the result of what geologists term destructional processes. Its floral types are the saguara, the palo verde, and the catclaw. Its sparse agricultural products are fruit and wheat, its mineral resources gold and copper.

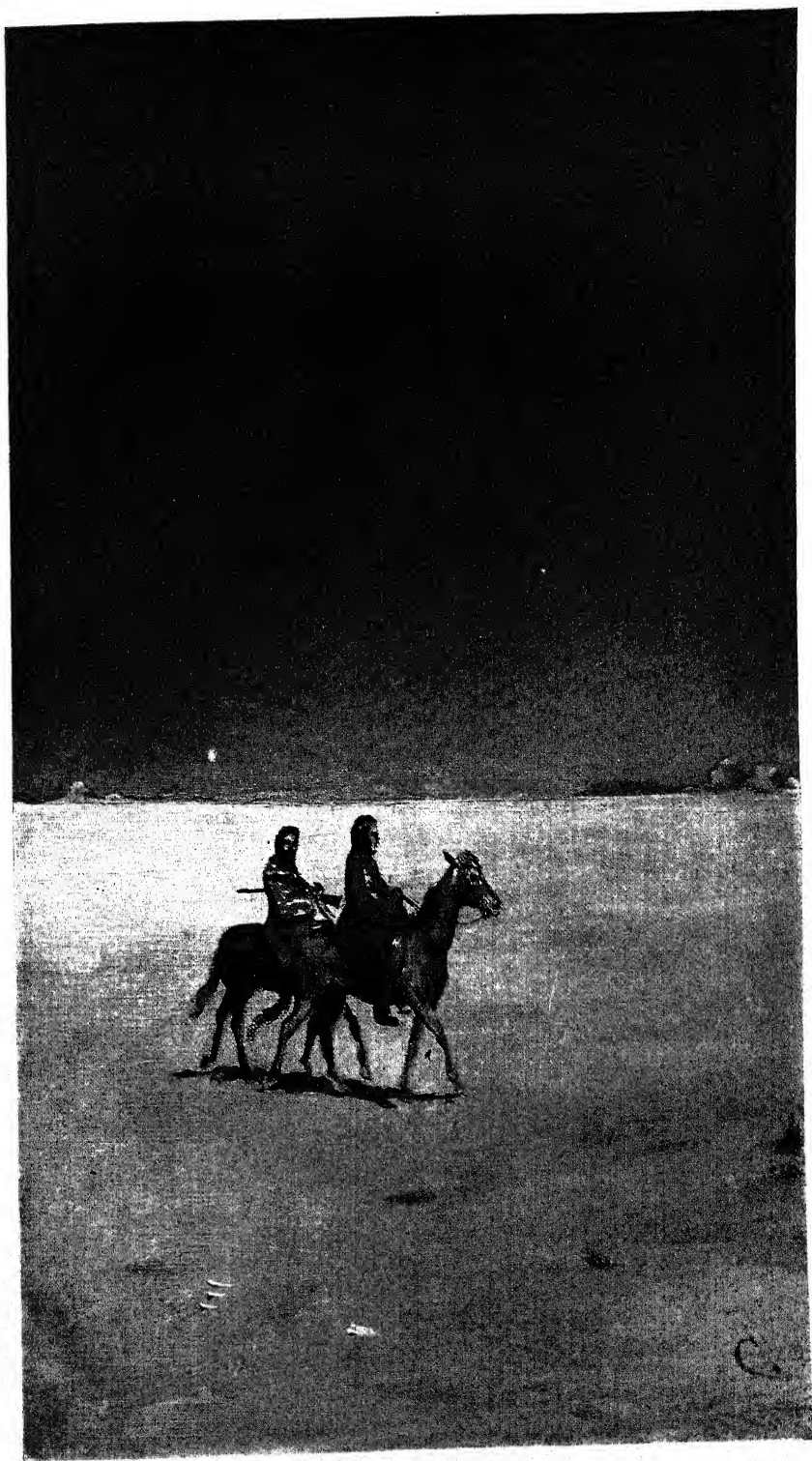
The Chihuahuan Desert, marked by parallel plains and ranges, is a relatively higher region; its features are a combination of destructional and constructional processes. Its floral types are the maguere cactus and yucca; its chief agricultural product maize (corn), and its principal mineral product silver.

While the desert plains may be extensive, they also have many phases of variation. There are the alkali plains, white crystal patches of saline efflorescence which vegetation abhors, and vast plains of "doby" (adobe)—brownish chocolate clay soils through which here and there are cut the deep channels of streamless streams. There are the dreary "tabosa" flats covered by headlike bunches of a woody grass, abhorred by animals and useless to man, through which one may travel for days. The great white gypsum desert of the Tularosa valley of New Mexico is one of the most wondrous of all the desert plains. To the eye it is a veritable sea of purest granular snow, marked with wind waves and ripples like the Tropic Ocean, with billows and troughs. Yet it is not snowlike in its torrid heat, which burns and thirsts more than man can tell. In some places there are extensive lakes of crystalline salt which the desert inhabitant uses for herd and flock. Sometimes there are stretches of dreary brown sand hills, great billows gathered around the protecting roots of the thorny mesquite, the particles blowing with each breath of wind, ever seeking a resting place, though seldom finding one.

The half cannot be told of the many other aberrant features of the Great American Desert, like Death Valley, with which no spot in Sahara can compare for sterility and desolation; the great "medanos" or white sand dunes just south of El Paso, each as high as the national capitol, which creep from place to place over the desert plain; the vast plains of malpais in New Mexico with their burning, cutting, black, waterless surfaces of lava; the "flour dust" deserts of Jimenez and Arizona and Sonora, where the traveler is choked with clouds of chalk-white powder; the Crow Flat with its glare that blinds, the Jornada del Muerto, with its hundred whirlwinds, the saguara deserts of Sonora, where







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for hundreds of miles grows no blade of grass, or many other spots which are apparently a mockery of nature.

The clouds are the most wonderful manifestations of the desert heavens. The forms of vaporous atmosphere are numerous. In the morning they fill the valleys with snow white vapor, which at midday rises and gathers into solitary fluffs sailing majestically along like great icebergs in a sea of azure ether, or again breaking into small bunches like flocks of sheep. Frequently from one little handful of cloud surrounded by golden sunshine, a ribboned spray of rainfall may be seen dropping upon some lonely spot. Toward night they gather in rolling banks and settle upon the mountain tops, rapturously lingering near the horizon, where they are painted by the setting sun in floods of glorious gold and violet.

Sometimes showers freshen the desert. These are occasionally of sufficient volume to dampen the earth and vegetation, and an awakening of life ensues which is most remarkable. From every shrub and cactus comes a burst of song from birds ordinarily unnoticed. Rabbits creep out and browse, coyotes give tongue in chase of prey. Vegetation seems to awaken instantaneously, plants which before were dry and dust-covered unfold into broad areas of vivid green. Coriaceous ferns, ordinarily lying like dead leaves among the stones, unroll and wave their fronds in the freshened air. From the inconspicuous flowers of the many thorny shrubs of the acacia and yucca tribe the air is laden with perfume.

It would seem paradoxical to speak of the desert in bloom, but the human senses of sight and smell can be regaled by no more pleasant experience than the delicate odors and sweeps of color that sometimes follow an unusual rainfall. Sweeter than the dewy jessamine is the scent of the yellow catsclaw; more delicate than mignonette is the panule of the mesquite.

Like a dainty pencil line drawn across the sheet of desert, the trails may be seen for miles and miles. These, originally made by the wild Comanche and Apache, lead in long tangents from water-hole to water-hole, cutting paths of deep-worn ruts. Were it not for these trails connecting the various water places the desert probably would be impassable, for the priceless water is usually concealed in spots where least suspected. These water-holes were discovered by the aborigines long before the ranchman and settler came or the army wagons and cavalry troops deepened the impress of the trails. What stories of death and pain, thirst and starvation could be told by these old trails! We know that as early as 1528 many of them existed, for in that year Cabeza de Vaca and his three shipwrecked survivors of the Navaez expedition followed these paths from water-hole to water-hole across our southern border, and that modern commerce and migration still use these, the oldest and most stable monuments of the desert.

In the desert water is king. Without its countenance priceless ore is but as dross, and fertile soils are as worthless ashes. Upon the desert plains many men and cattle have died for the want of a drink of water, which millions could not buy. Water is not only the king of the desert, but its despot. It smiles at the millions of acres of land owned by a certain uni-

versity as a part of its endowment which is still ungraced by its favor. It laughs at the waterless miles upon which the United States invites settlement under the homestead laws; it defies those who would take the rich gold from the placers of the deserts of Sonora and Arizona, where the gold would remain forever without its precious favor.

Like the Sahara, the Great American Desert is superficially waterless. Its plains are usually barren of surface water save for an exceptional saline lagoon. A few brooks, streams, or rivers arise within its larger mountain ranges, but no water ever runs off its surface to the sea. Even the great floods of water which sometimes burst from an erratic cloud with devastating effect are rapidly swallowed up by the sands or evaporated by sun and wind. It is true that there are two long rivers comparable to the Nile of the Sahara—the Colorado and the Rio Grande—which rise in the higher forested mountainous border lands and flow into and across the deserts like great canals, without gathering contributory drainage from them, losing volume in fact from absorption and evaporation in the desert portions of their courses. These are rivers born of the mountains, however, and not of the deserts.

Upon the area of the Great American Desert the maximum rainfall is less than 15 inches per annum, and does not average more than 10 inches. In places such as Death Valley and the Yuma Desert it is less than five inches, these two spots being perhaps the driest in the known world. Deducting from this maximum of 15 inches 60 per cent of its effectiveness, due to loss through evaporation, the actual rain value is only six inches per annum, less than the amount falling in the two crop-growing months of May and June in the eastern States, and less than one half the quantity that fell in September 1901 in a single 24 hours at Galveston, Texas. To this great natural fact the desert is resigned, that within its area the land with a few exceptions, not amounting to 3 per cent, is permanently and hopelessly dry, and even the most sanguine cannot refute this fact.

Before the railways came, the Great American Desert was a most primitive region. In 1880 it was inhabited by a population about as dense as that of the Sahara now, but practically in the same state of culture; and the mission bells rang over the same civilization that existed in 1528. The inhabitants practised irrigation, agriculture, and architecture very much like that of the Egyptians of to-day, and constructed dwellings of unburnt brick and stone. The aborigine found sustenance on the desert, but of a kind upon which the white man could not well exist. Maize was his staple of diet. This with the tunas (fruit of the prickly pear) and the roots of various yuccaceous plants, supplemented by a few wild animals, provided an aboriginal diet pure and simple.

It was no great feat for the Spaniard who already possessed an Old-World knowledge of desert craft to amalgamate with the aborigines. He gave to them a few domestic animals (the goat and the burro, which can live where other animals starve). He also gave to them the Catholic religion and the Spanish language. For nearly 400 years the desert population made no progress in industrial civilization beyond adopt-



## DESERT

ing the wooden plow and the cumbersome wheeled cart known as the *carretta*.

In Mexico the old desert cities and country estates were practically in the same status of civilization that existed in the 1st century after discovery. The cities had no commerce except by caravan; the estates were great feudal districts with their fortified *haciendas*, to which all the surrounding people were attached as fiefs. For 200 miles along either side of the international border in Mexico and our own desert country the unconquered Apache spread devastation from the Pecos to the Colorado; and the only white men there were the soldiers at scattered and lonely outposts, or "bad men" endeavoring to hide from civilization, and hardly better than the Apaches in instincts or action. Here and there in the United States at the widely dispersed water-holes were a few nomadic ranchmen who owned cattle of primitive breed for which there were no purchasers, except the army and beef contractors. Some mines there were also, but these were merely those with easily reducible ores and limited in depth by the distance which a man could dig in solid rock without machines or powder, and from which burdens could be carried on the human back. In Utah alone had the white man attained a foothold, but the Mormons were men who sought the desert to escape civilization, with the ambition of reverting to a culture as purely barbaric as that of Abraham and his descendants who now live in the Sahara.

With the advent of the railroads the modern conquest of the desert began. It was first awakened from its centuries of lethargy by the whistle of the locomotive in the eighties. In the Great American Desert in the United States and Mexico there are now more than 9,000 miles of railway. But for the railroad the Great American Desert would to-day be as unproductive as the Sahara, and still populated, like the Sahara, by people who exist without division of labor, the use of mechanical appliances or extra-territorial commerce. The first railways to be constructed were designed merely as highways between the Atlantic and Pacific seaboard. No thought of revenue from the desert itself was anticipated. Next came a great longitudinal line following the ancient trails of the Aztec from Mexico to Santa Fé. Mining and population soon followed these trunk lines, which are now extending out even into the utmost recesses of the desert, and these feeders—built or in process of construction—will soon equal the aggregate of mileage of the original trunk lines. From the Pecos in Texas to California, a distance of 1,500 miles, the route of the Southern Pacific followed a belt of country devoid of water except occasionally in the Rio Grande. Not a herd of cattle, a modern house, a farm or a mine existed along this desert stretch. Nor would they exist to-day had it not been for the construction of this railway. Now its course is marked by many prosperous embryo cities and villages.

Notwithstanding the apparent scarcity of water, one of the most remarkable features of the American Desert is that water has been secured, often in apparently impossible places, and in quantities which have made possible the existence of cities and industries. Like the deserts of the Sahara and Asia, those of America have a supply of underground water; there is

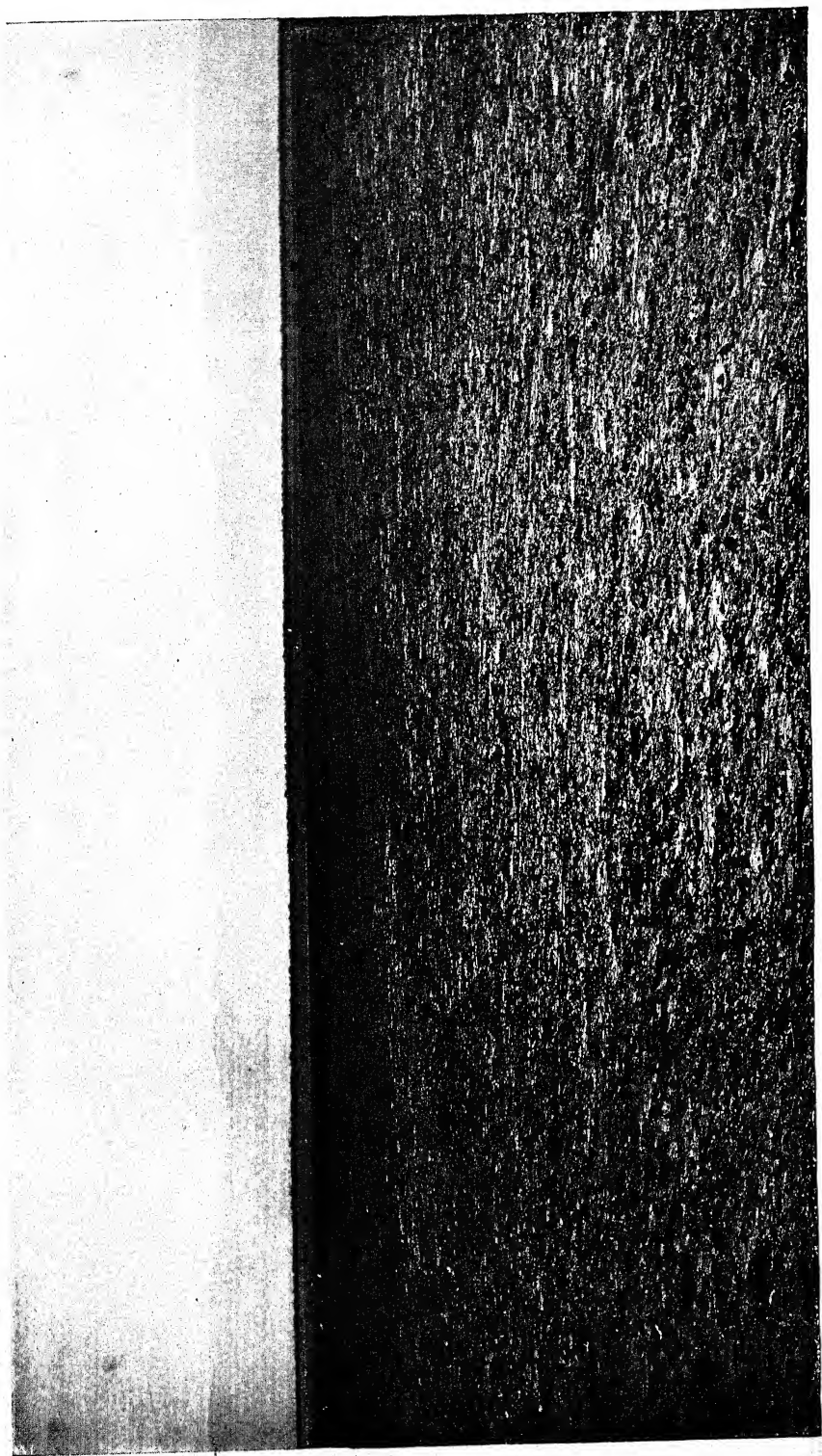
hardly a desert in which the experiment has been tried where waters have not been found within 2,000 feet of the surface. Though not often sufficient for agriculture, enough has usually been found to afford a supply for cattle, railroads, and mines.

Underground water has usually first been found by the railway companies. When the track was first pushed across the desert water was brought from the rear in tank cars; but when the track was completed water was bored for in the desert itself. The engineers have had at command a mechanical appliance second only in importance to the locomotive, and one which in the desert usually goes side by side with it. This is the mechanical drill. At great expense they bored in many places. The existence of underground water beneath any particular area having once been demonstrated by the railroad company, individuals, of course, usually repeated the experiment. Three notable triumphs of the mechanical drill over nature are the flowing wells of the Salton Desert, the flowing well at Benson and a supply of 700,000 gallons a day from the deep wells on the Mesa at El Paso. Each of these supplies of water was obtained from localities which superficially were hopelessly dry.

Several of the largest mines in the desert depend almost entirely upon the water transported on cars. The Copper Queen runs its vast smelters and machinery chiefly by water thus obtained, while the famous Sierra Mojada, of Coahuila, with its population of 5,000 people, has not a drop of water except that brought in tanks a distance of 125 miles. Yet these two mines annually return millions of profit.

But the sterile and hopeless-looking soil of the desert, when artificially watered, is apparently more fertile than that region where rainfall is abundant. There is no nobler spectacle than a dreary waste converted into an emerald oasis by water artificially applied, and in the desert may be seen some of the most profitable and skilful agriculture in the world. The wheat fields of Utah and Sonora, the great cotton farms of Coahuila, the alfalfa valleys of the Rio Grande and the orchards of California are all inspiring examples. The transformation made in the desert where irrigation has been possible is marvelous, and in one instance—in Southern California—has resulted in the development of communities of great wealth and culture, where the ideals of perfect conditions for existence are as nearly attained as possible.

A word of caution must be written, however, against an overestimate of the agricultural capacities of the desert. It is necessary artificially to collect the precipitation over large areas, and to concentrate it upon smaller areas by impounds and canals. In this manner at least 25 acres must be set aside as unproductive catchment areas for every one that may be cultivated. All rain water that falls upon the desert or upon its neighboring mountain, if it could be protected and carefully preserved, would not irrigate 5 per cent of the great desert area. The efficiency of the rain of the Great Desert region for agricultural purposes is still further diminished owing to the season in which it falls—June to October—too late for the growing crops, the planting and growing months of spring and early summer being dry. From a practical standpoint it is doubtful if even 1 per



A TYPICAL VIEW OF THE AMERICAN DESERT.



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cent of the vast area can ever be profitably tilled by irrigation. The underground water supply, too, is entirely insufficient for extensive agricultural uses, even when it is free from injurious salts; and the desert people, after every possible experiment, have long since ceased to anticipate any material supply for irrigation from this source.

From whatever point of view the problem is approached, the sober conclusions cannot be avoided that the desert as an agricultural country has its limitations. The only apparent way in which the area of irrigable lands can be seriously increased is by the construction of reservoirs to save the run-off of the forested mountains, especially that portion of the desert adjacent to the California, Utah and Mexican sierras. Even when this is accomplished there will still be left a vast area of desert. Hence the agricultural product of the desert will never be large, and this product with the exception of the fruits of Southern California will contribute but little for export, and will never be sufficient to supply the needs of its own population. The Great Desert is and will continue to be a profitable market for the consumption of the fresh and preserved food products and forage of the ocean seaboard and Middle West.

Notwithstanding the scarcity of water and forage the pastoral interests of the desert are considerable. Upon the stony foothills and in the mountain cañons the scant herbage and grass supply nutritious foods for many animals, and there are numerous cattle ranches, especially in the Chihuahua province, which are profitable and thriving. Statistics are wanting and hence exact figures cannot be given, but the live-stock values of the desert amount to several million dollars, exceeding the agricultural products many fold.

So far as even the present agriculture in the desert is concerned, it would not exist were it not that its products were consumed at good prices by the people engaged in mining and transportation. One good mining camp, a few acres in extent—and there are many of these—gives employment and remuneration to more people than whole countries of arid farming lands. Previous to the introduction of the railway, mining in the desert was limited to simple processes and products. Without mechanical drills and hoists only moderate depths could be reached, and limited quantities of ore taken out and treated. Consequently the deeper, larger and richer ore bodies remained untouched. Silver and gold were alone considered, and the mines which now yield over \$50,000,000 annually of copper could not be touched.

On the California trail near Pearce, Arizona, for 40 years the overland pioneers built their camp-fires against a ledge of quartz. Since the railway came these rocks are being crushed for the gold they contain at one of the most complete and profitable mills in America. The huge stamps and other machines were brought from New York, Pittsburg, Chicago and Denver; the oil for fuel to run them, from California; the food for the village of over a thousand people living in homes built of Texas lumber is all brought in from the great canning, packing, and fruit-giving sections of the country.

A dozen other places in the desert, each with its modern hoists, smelters, converters and electric appliances, are producing millions of mineral

wealth per annum. Not only have new mines been opened and equipped, but many of the historic old mines of Mexico, abandoned because the limit of hand mining had been reached, have been re-opened with the aid of the steam-hoist and air-drill, and to-day are more productive than ever.

The Great American Desert in 1900 yielded over \$100,000,000 worth of metals—chiefly silver, copper and gold. This represents at 10 per cent a productive capital of \$1,000,000,000. In addition to the paying mines, as large an investment is now being made in mine development and preparation for the coming of lines of railway which are everywhere reaching out to new mining fields. There is every possible reason to expect that the mineral output of the desert will be quadrupled the next decade. Mexico's production of gold has increased from \$4,000,000, in 1897, to \$10,000,000, in 1901; Arizona and New Mexico produced \$3,500,000 worth of gold in 1901. Silver, instead of being a dead metal, is being mined with renewed activity and improved appliances. The American Desert, in 1901, yielded about \$8,000,000 from the United States, and \$34,000,000 from Mexico.

The smelting interests are not the least important adjuncts of the mining industry, and each smelter gives employment to many workmen. The American Smelting and Refining Company, with its capital of \$80,000,000, has great central plants in the desert at El Paso, Aguas Calientes and Monterey. Many of the mines like Boleo, the Copper Queen, the United Verde and Greene Consolidated have their own smelting works.

Many mineral districts of the desert still lie unproductive for want of transportation. This is especially true of the great copper, gold and coal fields of the Pacific States of Mexico, while the rugged western Sierra Madre contain veins of ore awaiting transportation facilities which will furnish many new and important mines.

The total population of the Great American Desert in 1900 was about 1,500,000 people or 1.5 to the square mile, or twice as many to the square mile as the Sahara. Of this total population in the United States, 300,000 are in southern California, leaving less than one person to every two square miles in the remainder of the territory. Of the remaining 700,000 people in the American portion of the desert, at least four fifths are in cities, towns and mining camps. These people in their own picturesque language are by profession "prospectors," "punchers," "nesters," "miners," "lungers," "Mexicans" and "promoters." In plainer English, mineral seekers, cattle men, irrigator-farmers, miners, railroad employees, health-seeking consumptives and laboring Indians, who have abandoned the "blanket" caste, and men who serve as intermediaries between the latent wealth of the desert and the ready cash of the East. As a whole they are an energetic lot. In the United States they consist chiefly of two classes, the Caucasian, whose ingenious brain conceives and develops industries and the Mexican (Indian) peasant, who does most of the manual labor. Across the line in Mexico the same conditions exist, except that the American finds a ready co-operator and companion in the higher caste of Mexican citizens.

The mainsprings of the desert are the hustling western American miners and cattlemen. If any of our readers should still retain in his

## DESERT ANIMALS

mind as a type of the desert citizen the bad man with the slouched hat, flowing mustaches and quick-acting revolver, he is at least 10 years behind the times. Whether from the magnificent climatic conditions which induce healthfulness or from the fact that he represents the survival of the fittest, he comes very near the highest type of an American. Self-reliant, unaffected, well built, well dressed, well read and well traveled, he is a man of resources and action, available for any emergency, freer from provincialism, and a little more cosmopolitan than the average resident of any other section of our republic. The aboriginal population of the Great American Desert was and is of quite a different type from that of the nomadic savage who lived by the chase, in the forested mountains and upon the Great Plains. They were largely village dwellers, home builders and agriculturists who by the arts of pottery and weaving had risen to the cultured stage of barbarism as distinguished from savagery. It was their social arts and habits of industry which produced the highest aboriginal type in the ancient Aztec, and it is their blood (not the Spanish) which to-day constitutes the ruling spirit of the most advanced of the Spanish-American republics (Mexico). Upon the invasion of their environment, first by the Spanish and later by the Anglo-American civilization, they assumed at least a portion of these and to-day they are the people who constitute almost the sole laboring classes of the desert, being called Mexicans in the United States and peons or peasants in Mexico.

It is the intensity rather than the density of the desert population that appeals to the observer. Whatever is done is done better than elsewhere. This is a necessity of the desert condition. It will not pay in that region to trifle with inferior methods or products. In mining the best man and the best machine must be had; in farming with expensive water it is a waste to plant poor seed; if cattle are placed on the range they must be good cattle, and so on throughout the entire gamut of industry. The conquerors of the desert seem to inspire a higher plane of living than that met with in the older rural regions and crowded industrial centres of the United States. There is no quibbling over innovations; if good they are adopted. The universities and agricultural and mining colleges of New Mexico and Arizona would be creditable to any country and they are hampered by no quarrels over dogma or political opinions.

The desert cities, if not as densely populous as those of some regions, are unique in their thrift and prosperity. They are all picturesque communities, presenting an interesting mixture of architectural, social, and business conditions, busy with commerce and buoyant with hopes and prospects. Each desert city is thoroughly alive to municipal improvement and development. Electric lights and street cars, water-works, schools, churches, and public libraries abound, while many of the American towns have copied from their Mexican neighbors the picturesque plazas or ornate public parks within the central portions of the busy cities. In many of the Mexican desert cities may be seen the union of all the best of modern industrial improvement with the picturesque Spanish architectural features for which these places are

noted. Steam and electricity have asserted their mastery, but have concealed their cold mechanism behind the prettily stuccoed and flower-entwined walls of the artistic Mexican type.

The Great American Desert as a place of residence is one of the most salubrious on earth. The same climatic feature which renders it sterile—want of humidity—gives to its air a crystalline clearness and purity nowhere else found. At first sight the desert horrifies the passing traveler, but he who dwells in it for a time learns to love its life-giving air and landscape. In the noble wastes of rock and plain man's soul swells to contemplation and forgets the dross and sham of his artificial civilization. The endless vistas uplift the thoughts, and the skies seem to bring with them a clearer vision and content than all the mist and fogs that ever hovered over a humid landscape.

ROBERT T. HILL,

*Of the United States Geological Survey.*

**Desert Animals.** Men are apt to think of the vast tracts of absolutely treeless arid sand as uninhabited, because they are void of the creatures known to the regions where humanity dwells. Yet these tracts are often teeming with life. On the shadowless expanse which affords no lurking-place, animals, adapting themselves to the exigencies of their life, often assume the pale tints of the sands whereon, by lying motionless, they may be overlooked by their enemies. They not only develop a protective coloring, but acquire certain other capabilities. They learn, for instance, to subsist on a minimum of water, or to store it within their bodies, some, indeed, developing an ability to live altogether without direct water-supply. Many desert animals are said to aestivate, that is, to sleep throughout the summer, as animals of cold climate hibernate by lying dormant through the winter season. The desert snail, in order to protect itself from dessication, builds up a wall of mucus, sometimes with two or three layers, across the opening of its shell to prevent evaporation of its moisture during the extremest heats. Small desert animals, like plain-dwellers, are burrowers, not only because they can thus escape the fierce rays of the sun, but also because they are so protected against their enemies. Even some serpents burrow, and these are more virulently poisonous than corresponding species of a different habit. All the desert creatures, from the snakes and lizards to the camels, are provided muscularly with the ability to shut out from their nostrils and eyes the sand that is blown by the powerful winds; and most of the insects (except the locusts) are practically wingless, so that these strong desert currents do not carry them away.

The large desert animals are swift, and their feet are adapted for the hot rocks and sand by being cushioned beneath with callous skin. The swiftness of these animals is indispensable to their preservation; for they must generally escape their pursuers by flight, since their habitat affords no hiding-places; moreover, they have to travel long distances for both food and water. Examples of this may be found in the camel and ostrich (qq.v.).

The desert is undoubtedly the refuge of certain animals which have been driven by competition from the more desirable habitations, and which, having located in arid land, have adapted

## DESERT LAND ACT — DESHOULIÈRES

themselves to their unfavorable environment. That they are the unsuccessful and outcast representatives of species living under better conditions is substantiated by the fact that they are almost always closely related to the forms in the fauna of the green, fertile lands beyond the desert; the differences usually being only the changes necessitated by difference of habitat.

**Desert Land Act**, a statute of the United States passed 3 March 1877, and supplemented in 1891, to encourage irrigation by private individuals or associations. It provides that any citizen or intending citizen, by paying a registration fee of 25 cents, and declaring his intent to irrigate within three years, may occupy desert land not exceeding a section (640 acres) in any of a number of specified Western States and Territories, and if he reclaims it within that time may receive a patent for it. He must spend at least \$3 per acre in irrigation or securing water rights; and must have secured the rights before making application. Associations may file joint declarations.

**Desert Plants**, such plants as are characteristic of arid regions; in general marked by structures adapted to check transpiration of water, such as reduced leaf-surface, absence of leaves, thickened epidermis, hairy or waxy coverings, stomata ("breathing apparatus") in sunken pits, the entrances to which may or may not be protected by hairs, perennial underground parts such as bulbs, tubers, rhizomes; and annual plants which flourish during the wet season, where such occurs, and, like the tops of many of the perennial herbaceous species, die during the dry season. On the other hand water-absorbing organs are often highly developed; the root-systems are not only large but the root-hairs are exceedingly numerous. Storage organs other than underground parts are common, as in many plants with fleshy leaves and in the thick stems of cacti. In regions of less and less rainfall the vegetation becomes more and more monotonous and restricted to the most resistant forms. In addition to intense heat and light, drying winds and small rainfall, the plants have often to adapt themselves to withstand salts which are brought to the surface in solution and left as the water evaporates.

Structural differences and similarities may be observed in the plants characteristic of Alpine and Arctic conditions. Another striking character of desert plants is their restriction to a limited area (see ENDEMISM) by isolation and by enforced adaptability to peculiar conditions, in which respects desert and Alpine plants are similar, but in which each differ from Arctic plants that have a wide range. See ALPINE PLANTS; ARCTIC PLANTS; HALOPHYTES; PLANT GEOGRAPHY; XEROPHYTES.

**Desertas**, dǎ'sēr-tās, a group of three small rocky islands in the Atlantic Ocean, to the southeast of Madeira, visited at certain seasons of the year by fishermen and herdsmen.

**Deserted Village, The**, the title of a poem by Oliver Goldsmith (1770). It is supposed to describe the village of Lissoy, in the County of Westmeath, Ireland. See GOLDSMITH, OLIVER.

**Deserter**, in military affairs, a soldier or sailor who quits the service without leave. In the United States desertion from the army or navy in time of war is subject to court-martial

which nearly always means a sentence of death. Desertion under ordinary conditions is punishable by dishonorable discharge and five years' hard labor. The United States government offers a monetary reward for the arrest and delivery of a deserter, the sum usually ranging from \$20 to \$30. In every civilized country the laws against desertion are similar to those of our own land—always severe upon the man who abandons his duty, punishing him with harshest discipline, and sometimes, death.

**Desertion** by either husband or wife without lawful reason is sufficient cause for legal separation, or instituting proceedings for divorce. A wife, however, may secure an order to protect money or other possessions she may acquire from the time of desertion. This makes her property immune against husband or his creditors. On the other hand the husband is not held responsible for any debt or contract his wife may engage in during her voluntary leave of his "bed and board." In nearly all parts of the United States, as well as in countries of Europe, desertion is good ground for divorce, though there are differences as to the period of time which must elapse before action can be instituted.

**Desfontaines, Pierre François Guyot**, pē-ār frān-swā gē-ō dā-fōn-tān, Abbé, French writer; b. Rouen 1685; d. Paris 1745. He was one of those known to us more for their controversies with Voltaire, and his biting attacks, than from their own productions. Voltaire, by the superiority of his wit, succeeded in gaining many to his opinions; but impartial judges have long agreed that he was not altogether correct, and that the criticisms of the Abbé Desfontaines, though severe, are by no means unjust. One of the works of the abbé, which had the misfortune to excite the particular displeasure of the poet, was the well-known 'Dictionnaire Néologique,' of which the sixth edition appeared in 1750 and which was intended to guard the purity of the French language, as the great writers of the 17th century had formed it; and in this respect it has certainly proved of much service.

**Desful**, dēs'fool, or **Dizful**, dēz'fool, Persia, city in the province of Khuzistan, 30 miles northwest of Shuster. About 30,000 inhabitants.

**Desgoffe, Blaise Alexandre**, blāz ä-lēks-āndr dā-gōf, French painter; b. Paris 17 Jan. 1830. He is famous for having imitated jewels and trinkets with pastes, and transparent coats of color. Among his works are: 'Oriental Agate Cup of the 16th Century,' after the original in the collection of jewels in the Louvre; 'Oriental Vase on Enameled Pedestal of the 16th Century'; 'Amethyst Vase of 16th Century'; Luxembourg; 'Onyx Jug'; 'Money Bag of Henri II., Enamels of Jean Limonsiu,' Luxembourg; and many fruit and flower pieces.

**Deshoulières, Madame Antoinette de Ligier de la Garde**, ān-twān-ēt dē lē-zhē-ā dē lā gārd dā-zoo-lē-ār, French poet; b. Paris 1 Jan. 1638; d. there 17 Feb. 1691. During the war of the Fronde she followed her husband into exile at Brussels, and he rescued her after she had been for eight months imprisoned at Vilvoorden as a suspicious personage. She was called the 10th muse and the French Calliope on account



of her idyls 'Les Moutons' and 'Les Fleurs.' Her subsequent failure in writing tragedy caused this advice to be given her: "*Retournez à vos moutons.*" Her best work and inspirations are found in her 'Idylls,' especially in 'The Sheep,' 'The Flowers,' 'The Birds.' Voltaire was of opinion that of all the French poets of her sex she had the greatest merit. Several learned societies elected her a member, and her agreeable manner, her animation and wit, which sometimes, but rarely, gave way to a gentle melancholy, made her the centre of attraction in the best societies at that period.

**Desiccation**, the evaporation or drying off of the aqueous portion of bodies. It is practised with fruit, meat, milk, vegetable extracts, and many other matters. It is usually done by a current of heated dry air, and as such may be considered as distinguished from evaporators, so called, to which furnace heat or steam heat is applied.

**Desiderio da Settignano, Di Bartolommeo Di Francesco**, dā bār-tō-lōm-mā-ō dē frān-chēs-kō dā-sē-dā-rē-ō dā sēt-tēn-yā'nō, Florentine sculptor: b. 1428; d. 1476. He was a pupil of Donatello. His chief work is the tomb of Carlo Marsuppini, chancellor of the Florentine republic, in the church of Santa Croce. Another church in Florence possesses a statuette of the Infant Jesus by this sculptor, of which there is a replica in the Louvre. The genuineness of many busts attributed to him has of late been disputed.

**Desiderius**, Lombard king. He was the last ruler of the Lombards and after being besieged in Pavia by Charlemagne was carried captive to France.

**Design**, in painting, the first plan of a large work, drawn roughly, and on a small scale, with the intention of being executed and finished in large. See **DRAWING**.

In music, design means the invention and execution of the subject in all its parts, agreeably to the general order of the whole, especially in the composition of works of classical formulae as required by a sonata or symphony.

In manufactures, design expresses the figures with which the workman enriches his stuff or silk, and which he copies after his own drawing, or the sketches of some artist.

In architecture, a plan of an edifice as specified by the ground-plans, elevations, sections, and any other outlines necessary to guide its construction.

**Design, Schools of**, schools in which art is taught with an industrial application in view rather than a purely æsthetic end. Theoretically such schools may be considered as intermediate between schools of technology, in which (with the exception of the architectural courses) designing is of a purely mechanical nature and application, and schools for the training of artists; yet in actual practice this distinction is not always followed. The best results in applied art are produced by foundation work similar to that essential in preparation for a distinctively æsthetic career. The courses in such schools vary in detail but generally include most of the following branches: free-hand drawing; the theoretical principles of decoration, and the history of art—especially in its decorative aspects; copying and variation of designs;

original designing for textile fabrics, wall-paper, stained-glass, pottery, leather-work, book-covers, etc.; and the study of the best examples of designing—for which accessible museum collections are essential. To this is added instruction in technical manipulation.

The definite endeavor to promote art education with the purpose of developing and improving the art industries of the nation had its rise in England as a result of the first international exhibition, that of 1851, at Hyde Park, London. In the United States a similar movement originated in Boston in 1870, and was an outcome of the former. The related branches of industrial art drawing and manual training owed much to the impetus given by the Centennial Exhibition of 1876. The new spirit was felt by the public schools and wrought marked changes in them during the next quarter of a century, and museums of art were created and developed. Among the institutions offering courses in applied art in the United States, may be mentioned the schools of Cooper Union; the Lowell Free School of Industrial Design (1872), affiliated with the Massachusetts Institute of Technology; the School of Design for Women in Philadelphia; the School of Design of the University of Cincinnati; and the University of Minnesota, which has a four years' course in drawing and industrial art. The large cities of Europe were provided with facilities for teaching industrial art long before such a necessity was apparent in Great Britain and the United States. In Paris the École Nationale et Spéciale des Arts Décoratifs, in Berlin the Bau Akademie, and in Vienna the Imperial Art Institute, may be especially noted. The great schools devoted to the training of artists created the atmosphere and impulse without which the more practical schools would be impossible, but they hardly come within the scope of this review. Among the results produced in Great Britain by the recognition in 1851, of the superiority of France in the arts of applied design, was the creation of the South Kensington Schools and Museum of Art, which have been powerful factors in effecting the great change in that nation. See **ART EDUCATION**.

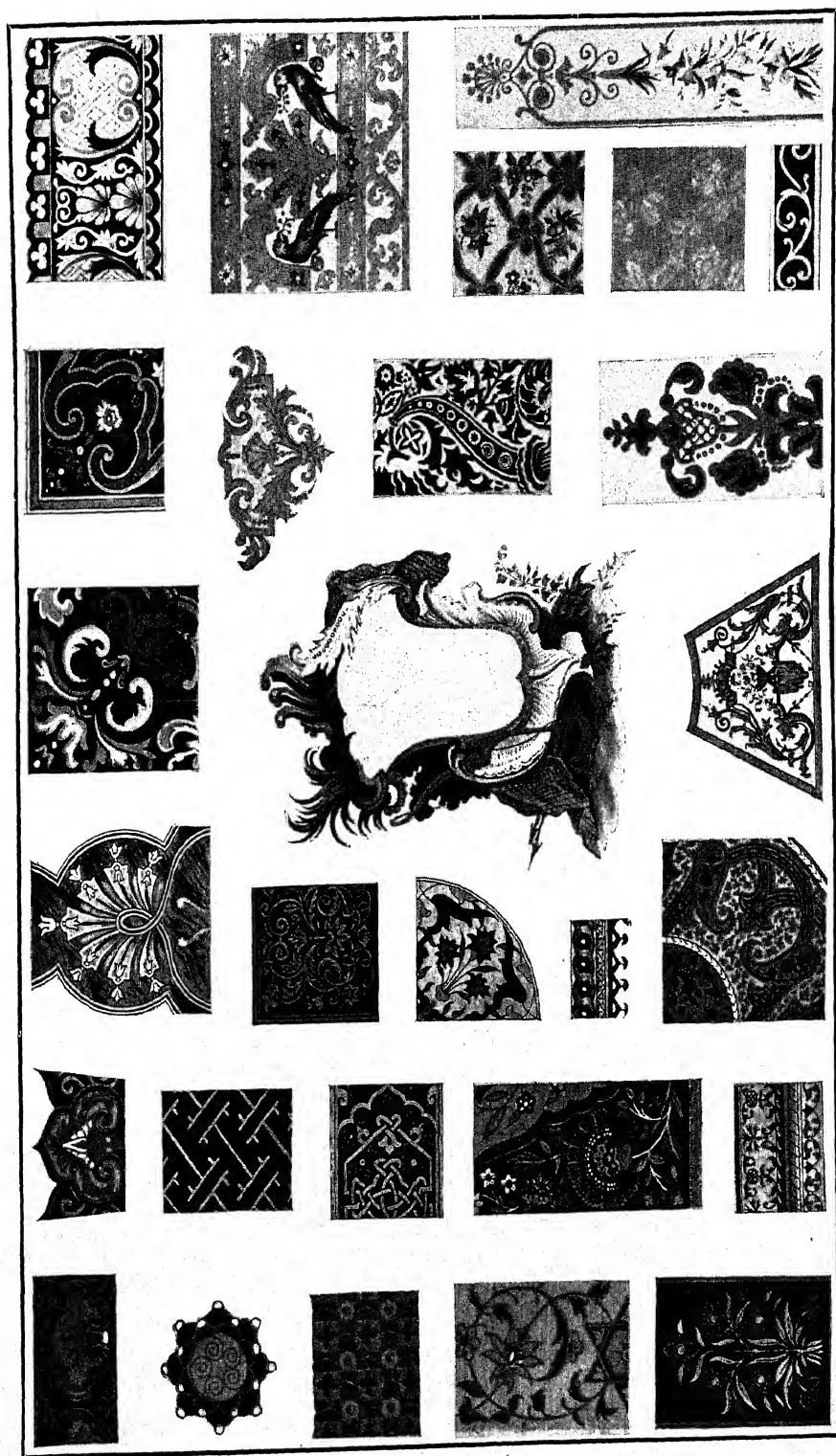
**Désirade**, dā-zē-rād, an island of the West Indies, dependency of Guadeloupe, from which it lies about nine miles to the east. Since 1814 it has been a French possession. It has an area of 10 square miles, and a population of about 1,300, composed mainly of emancipated slaves. It is known as the island which Columbus first discovered on his second voyage in 1493, and to which he gave the Spanish name Deseada, "desired."

**Desjardins**, dā-zhār-dān, **Alphonse**, Canadian journalist and politician: b. Terrebonne, Quebec, 6 May 1841. He was educated at Masson and Nicolet colleges, and was admitted to the bar in 1862. In 1868 he turned his attention to journalism, was on the staff of 'L'Ordre,' and later became editor-in-chief of 'Le Nouveau Monde.' He assisted in organizing the Papal Zouaves sent to the aid of the Pope in 1868, and is a member of the Order of Pius IX. He was a member of the lower house of the Canadian Parliament 1878-92, and was then called to the Senate. In 1893 he was mayor of Montreal, and in 1896 for a short time minister of militia, and then minister of public works.





# DESIGNS



European and Asiatic Designs of the 17th and 18th Centuries.



## DESJARDINS — DES MOINES

**Desjardins, Martin**, mār-tān, gallicized name of **Martin Vanden Bogaert**, French sculptor: b. Breda, 1640; d. Paris 2 May 1694. He excelled as a sculptor, decorator, and wood-carver, executing many works for the churches of Paris, the College of the Four Nations, palace of Versailles, etc. His chief work was a monument to Louis XIV. 1686, removed in 1792 and destroyed save a few parts now in the Louvre and the Invalides. Another Louis XIV., an equestrian statue, remains at Lyons, with several portraits in busts and bas-reliefs at the Louvre and at Versailles.

**Desman**, dēs'mān, a genus of aquatic mole-like animals of the family *Talpidae*. The two species are different in habitat and in size, the larger (*Myogale moschata*) being found in Russia, the smaller (*M. pyrenaica*) on the slopes of the Pyrenees. In both species the fore limbs are not, as in other moles, adapted for digging; the feet are completely webbed, the hinder ones being quite large; and the snout forms a long flexible proboscis. The tail is long and scaly. This animal inhabits a burrow in the bank of a stream, and feeds upon insects, river-mollusks, and such food as it finds in the mud of the banks. Though its flesh is not edible, it is hunted by the Russian peasants for its fur.

**Desmarets de Saint Sorlin, Jean**, zhōñ dā-mā-rā dē sāñ sōr-lāñ, French poet: b. Paris 1595; d. there 28 Oct. 1676. He was a favorite of Cardinal Richelieu, and one of the first members of the Academy. He wrote several plays, among them a character comedy, 'The Visionaries' (1637), received with great favor. Some of the comic figures had Molière for their original. He wrote also epics: among them 'Clovis' (1657), and 'Mary Magdalene' (1669). In his early years he led a wild, disordered life; but later became a devotee, and wrote many religious poems and anti-Jansenist polemics.

**Desmarres, Louis Auguste**, loo-ē ô-güst dā-mār, French oculist: b. Evreux 22 Sept. 1810; d. Neuilly 23 Aug. 1882. He powerfully promoted the knowledge of the pathology and anatomy of the eye, and invented an ophthalmoscope now generally used. His 'Theoretical and Practical Treatise on Diseases of the Eyes' is a standard authority.

**De Smet, dē smēt, Peter John**, American Jesuit missionary to the Indians: b. Dendermonde, Belgium, 31 Dec. 1801; d. St. Louis, Mo., 23 May 1873. In 1822, being yet only a scholastic in the order, he was sent by his superiors to join the Jesuit mission in the United States and was an instructor first in the Indian school at Florissant, Mo., and then (1828) in the university newly founded at St. Louis. After this, having been ordained priest, he entered on his destined field of labor as missionary to the aborigines, traversing on foot or in canoes or with whatever means of conveyance was possible, the regions inhabited by the Potawatomes, 'Sioux, Blackfeet, Flatheads, Pend' Oreilles, and other tribes in the valleys of the Missouri, Yellowstone, Platte, and Columbia, and on both sides of the Rocky Mountains. On many occasions he was a commissioner on behalf of the United States government in pacifying the redmen when, provoked to fury by the wrongs done them, they went on the war path. In his journeys he wandered over 100,000 miles in those

wildernesses in the course of his labors of 40 years. But in the meantime he made visits to Europe repeatedly, to collect funds for support of the missions and to enlist young men for labor in the same field. His collections in Europe amounted to 1,000,000 francs. He wrote several narratives of his experience in the western wilds, among them, 'Letters and Sketches of a Residence in the Rocky Mountains' (1843); 'Oregon Missions' (1847); 'Western Missions' (1863); 'New Indian Sketches' (1868).

**Desmidiaceæ**, dēs-mīd-i-ā'sē-ē, or **Desmidiææ**, a natural order of microscopic freshwater *Algæ*, not unlike diatoms in some respects, but easily distinguishable from these by their color and the fact that they have non-silicified walls. They are green gelatinous plants composed of variously formed cells having a bilateral symmetry, which are either free, or in linear series, or collected into bundles or into star-like groups, and imbedded in a common gelatinous coat. Reproduction is effected, as in diatoms, either by conjugation, or by the halves of a cell developing between them two bud-like projections, each of which ultimately forms with its adjacent half of the old plant a new individual. Their beautiful forms make them much-prized objects for the microscope.

**Desmodium**, a genus of plants of the natural order *Papilionacæ*, or pea family. In recent classification it is included in *Meibomia* (q.v.).

**Desmognathæ**, dēs-mōg'na-thē, one of the groups of carinate birds proposed by Huxley. The vomer is absent, or at least reduced and slender, and the maxillo-palatines are united in one of several ways across the middle line. The great diversity of the contents of this group will be evident when it is mentioned that it includes the ducks, cuckoos, parrots, kingfishers, etc.

**Des Moines**, dē moin, Iowa, city, capital of the State, and county-seat of Polk County; at the junction of the Des Moines and Raccoon rivers, and on the Rock Island, the Northwestern, the Burlington Route, the Chicago, Milwaukee & St. Paul, and several other railroads. It is built on a plateau from 15 to 20 feet above the tidewater and is intersected by both rivers, which are spanned by eight bridges. The business portion lies near the rivers, and the residences are on the higher grounds beyond.

The city has two public parks of 40 acres each, and spacious State fair grounds. Among the notable buildings are the Old Capitol, erected in 1856; the New Capitol, erected at a cost of \$3,000,000; the United States building, containing the post-office and federal courts; the State library, with 50,000 volumes; the Grand Opera House, city hall, State arsenal, and about 75 churches. The city is located in the centre of a rich coal-mining district, the mines in the vicinity employing 2,000 persons, and having an annual output of 600,000 short tons. The principal industries, besides coal-mining, include pork packing and the manufacture of starch, glass, liquors, pipe, brick and tile, foundry and machine shop products, and brass goods. Good public and parish schools provide for the elementary education of the young; and in addition there are several high schools, the Des Moines College, Drake University, and Highland Park Normal College. Pop. 62,139.



## DES MOINES COLLEGE — DE SOTO

**Des Moines College**, a coeducational institution at Des Moines, Iowa, was organized in 1865 under the name University of Des Moines. This name was afterward changed to Des Moines College in order to conform more nearly to the aim of its supporters, the Baptists of Iowa. Like most schools of the kind, it has passed through severe financial struggles and reverses. It is now entirely free from debt, with an invested endowment of about \$80,000 and pledges sufficient to increase this sum to \$100,000. It also has a beautiful campus comprising two blocks, upon which are two substantial brick buildings. An additional block adjoining is set apart as an athletic field, the whole comprising about nine acres and valued, with the buildings, at \$60,000. The school has four departments: college, academy, music, and art. The college has steadily maintained as its aim a high class of work, and has taken rank with the best of Iowa colleges. It has 22 instructors. It was the first college to become affiliated with the University of Chicago. Under this arrangement the work of the school is constantly subject to the approval of the University. Professors and instructors have ample opportunity to carry on their own studies, either in attendance at the University or by correspondence.

J. P. STEPHENSON.

**Des Moines River**, the largest river in Iowa; formed by the east and west forks in southwest Minnesota; flows south-southeast to the capital city, then southeast to a point about four miles below Keokuk, where it empties into the Mississippi River; estimated length, 500 miles. It drains 10,000 square miles in Iowa; flows through a region rich in agricultural and grazing grounds, bituminous coal, and timber; receives the water of Raccoon, North, Middle, South, and Boone rivers; and with a fall of eight feet supplies a large number of valuable mill sites along its banks.

**Desmoulins, Benoît Camille**, bē-nwā kāmēl dā-moo-lān, French revolutionist: b. Guise, Picardy, 2 March 1760; d. Paris 5 April 1794. From the commencement of the Revolution he was connected with Robespierre, with whom he had studied at college. His friendship for Danton was the cause of his fall. Robespierre, at the head of the committee of Public Safety, was making rapid progress toward tyranny. Danton, assisted by the leaders of the Cordeliers, intended to resist this committee, and Camille commenced the attack in his journal, 'Le Vieux Cordelier,' in which he declared himself against the terrorists, and even made use of the word clemency. With Danton he was arrested on the order of Robespierre on 30 March 1794. On 2 April he was tried and condemned, and on the 5th was executed.

**Desnoyers, Auguste Gaspard Louis Boucher**, ô-güst gās-pār loo-ē boo-shā dā-nwā-yā, BARON, French engraver: b. Paris 20 Dec. 1779; d. there 15 Feb. 1857. At the age of 20 he received a prize for an engraving of Venus disarming Cupid, and in 1801 established his reputation by the reproduction of Raphael's 'Belle jardinière,' in the gallery of the Luxembourg. His most admired productions are copies of that great master's works, and prominent among them is an engraving of the 'Transfiguration.' He was elected a member of the institute in 1816, appointed chief engraver

to the king in 1825, created baron in 1828, and officer of the legion of honor in 1835.

**Desnoyers, dē-nwā-yā', Louis**, French journalist and novelist: b. Replonges, Ain, France, 1805; d. Paris 17 Dec. 1868. He founded the journal 'Charivari' (1832), and was one of the founders of the 'Siècle.' He wrote some vaudevilles, and several novels, such as 'Adventures of Jean-Paul Choppart' (1836); 'Mémoires of a 20-Sous Piece' (1837).

**De Sola, Abraham**, Canadian rabbi: b. London, England, 18 Sept. 1825; d. New York 5 June 1882. Under the careful supervision of his father he received a thorough Hebrew education, and having perfected himself in his general studies, he was called in 1847 to Montreal, Canada, by its Portuguese-Hebrew congregation. His scholarship and energy soon brought him to the front, and in 1848 he was appointed professor of Hebrew and Semitic literature in McGill College, Montreal. His literary labors consisted partly of contributions to the 'Occident' of Philadelphia and 'The Jewish Messenger' of New York, on historical and rabbinical themes, and partly of a revision of the Portuguese-Hebrew liturgy. On 9 Jan. 1872 he opened the House of Representatives of Washington with prayer, the first foreign clergyman to have received the privilege. Among his more important works may be mentioned: 'The Sanatory Institutions of the Hebrews'; 'Lectures on the Mosaic Cosmogony'; and 'Scripture Zoology.' He was for many years president of the Natural History Society of Montreal.

**Desol'ation Land, or Desolation Island**, an island belonging to Chile, in the archipelago of Tierra del Fuego. It is 70 miles long and about 15 miles in breadth. The name Desolation Island is also sometimes applied to Kerguelen Land in the Indian Ocean. See KERGUELEN LAND.

**De Soto, dā sō'tō, Bernardo**, Costa Rican statesman: b. 1854. He was elected president of the republic in 1887. During his administration the finances of the country, disordered by Guardia, were placed on a secure footing, and the work of completing the interoceanic railway from Port Limon, on the Caribbean Sea, to San José, the capital, and thence to Punta Arenas, on the Pacific coast, was prosecuted. Under him the long-dreamed-of unification of the central American republics became an accomplished fact.

**De Soto, Hernando**, ār-nān'dō, Spanish nobleman, conqueror, and explorer: b. Villanueva de la Serena (Badajoz) about 1496; d. 1542 or 1543. The date of his birth can not be ascertained precisely, some authorities placing it as late as 1500. But that which is here given is more likely to be correct, especially because we find him bearing a conspicuous part in central American expeditions between the years 1516-20. We can not easily assume that he was less than 20 in 1516. As a captain in 1523-4 he shared the adventures of Córdoba's fleet on the Nicaraguan coasts, and was overcome by Gil Gonzalez Dávila (q.v.) through treachery. Joining Francisco Pizarro in Panama with two ships, 60 men, and 10 horses, to take part in the conquest of Peru, he was appointed second in command. In 1532 he was the first Spaniard who spoke with Atahualpa; going to visit the unfortunate Inca in the character of an ambas-

sador, he continued to be well disposed toward him during his captivity. He returned to Spain in 1536, where he married in Madrid, the following year, Inés de Bobadilla, daughter of Pedrarias Davila (q.v.). Wholly misled by the first reports of the wealth of Florida, De Soto resolved to undertake the conquest of that country, which was represented to be as rich as Peru. He sold his property, and devoted the proceeds to the equipment of his ships and the outfit of his men, Charles I. bestowing upon him readily enough the title of governor of Florida and Cuba. At Sanlúcar he collected 950 fighting men, besides the sailors. Seven large ships and three small ones formed the fleet, his wife and family accompanying him in the San Cristóbal. Sailing from Sanlúcar 6 April 1538, he reached Santiago de Cuba safely, and there entered upon his duties as governor of the island; but transferred his authority at that point to his wife before proceeding to Havana (August 1538). By his orders Havana harbor was fortified (see CUBA). During the stay in Cuba his command was strengthened; 1,000 well-armed men were finally ready, and this was probably the best force which up to that time had undertaken the conquest of any part of America. The fleet sailed from Havana 12 May 1539. In Florida the Spaniards were moderately successful until they reached the province of Tascaluza, where a great host of natives attacked them. It was said that in this nine hours' fight 11,000 Indians fell, while on the Spanish side 70 were killed and nearly all (including De Soto himself) were wounded. Worn out by the long marches, which did not lead to the discovery of treasure, the soldiers plotted to abandon the enterprise. On learning of this, De Soto marched his men toward the interior, hoping to reach New Spain (Mexico) by land, and knowing that, at any rate, his followers would not care to desert him when the ships had been left far behind. In a nocturnal battle (December 1540) the Spaniards were again severely treated. Four months later they came upon a fort surrounded with a stockade, in storming which many were killed, and nearly all wounded. De Soto still led them forward, through the present Gulf States, and probably as far north as Kentucky, until he contracted a fever and died—according to Garcilaso, in 1542, though Herrera says 1543. The Spanish soldiers, who had thought to leave their commander in the lurch, were in this manner finally separated from him. At first they buried him in a trench the natives had opened near a village on the bank of a great river he had discovered; but several days afterward—either fearing the hostiles would dishonor the body, or suddenly realizing how they themselves might best honor it—they hollowed out the trunk of an evergreen oak, weighted the rude coffin with armor, placed the disinterred body within it, and sunk it by night in the deepest part of the river, which they called the Grande and we call the Mississippi.

MARRION WILCOX.

**De Soto**, də sō'tō, Mo., a mining city in Jefferson County, on the St. Louis, Iron Mountain & Southern Railroad, about 40 miles south by west of St. Louis, and 15 miles west of the Mississippi River. In addition to its mining interests of zinc and lead, it has a large trade in agricultural products. Its industries include

a flouring-mill, and the repair shops of the railroad. Pop. (1900) 5,611.

**Desoxybenzoin**, phenyl-benzyl-ketone,  $C_6H_5.CO.CH_2.C_6H_5$ ; obtained by the action of zinc and hydrochloric acid on chlorobenzil  $C_6H_5.CO.Cbl_2.C_6H_5$ , or by heating monobrom-stilbene with water to  $180^\circ$ . It crystallizes out of alcohol in large tables which melt at  $55^\circ$ . Desoxybenzoin can also be obtained by reducing benzoin  $C_6H_5.CO.CH(OH).C_6H_5$ .

**Despard**, dēs'pārd, **Edward Marcus**, Irish soldier: d. London 21 March 1803. He was superintendent of the English colony in Honduras. In consequence of complaints made against him he was recalled in 1790. This made him disaffected, and he matured a plan to assassinate the king on his way to open Parliament. The conspirators were arrested and tried by special commission at Southwark 5 Feb. 1803. There being no doubt of their guilt, Despard and nine of his associates suffered death.

**Despenser**, dē-spēn'sēr, **Hugh 1e**, English courtier: b. about 1262; d. 27 Oct. 1326. He distinguished himself as a soldier and diplomat in the service of Edward II. and became Earl of Winchester in 1322. His tyranny as the royal favorite led to a revolt of the barons and his own downfall.

**Despenser**, **Hugh 1e**, English courtier, son of the preceding: b. about 1290; d. November 1326. He deserted the baronial party for that of Edward II., and became a royal favorite. He and his father were involved in the misfortunes following the flight of King Edward from London, and were beheaded in the same year.

**Despériers**, Bonaventure, bō-nā-vān-toor dā-pā-rē-a, French writer: b. Arnay-le-Duc about 1505; d. 1544. He was secretary to Margaret of Navarre. He wrote a series of 90 stories: 'New Recreations and Merry Conceits,' printed in 1558. In 1537 was published his 'Cymbalum Mundi' in French, a virulent attack on the Christian religion, which was burned by the common hangman, and of which only one copy is in existence.

**Des Plaines** (dē plān) **River** (named from a species of maple called by the French *plaine*). A river of Illinois which rises in the southeastern part of Wisconsin and flows south and southwest until it unites with the Kankakee River at Dresden, Ill., to form the Illinois River. In length the Des Plaines is about 150 miles. For some distance the river flows almost parallel with the shore line of Lake Michigan. For several miles the waters of the Des Plaines have been made to contribute to the Chicago Drainage Canal (q.v.)

**Despoblado**, dāz-pō-blā'dō (desert), a name given in South America to any barren tracts in the Andes, which are so high and cold as to be uninhabitable. It is given as a specific name to (1) a treeless, uninhabited plateau, nearly 10,000 feet above the sea, on the Bolivian and Argentine frontier; and (2) a region in Peru between the central and western Cordilleras, ranging from 14,000 to 18,000 feet above the sea-level.

**Despot** (from the Greek *despotēs*), originally a master, a lord; at a later period it became an honorary title which the Greek emperors gave to their sons and sons-in-law when governors of provinces. Alexis III., surnamed Angelus,

## DESPOTO DAGH — DETECTIVE

toward the end of the 12th century, is said to have first introduced this title, and to have made it the first in rank after that of emperor. Thus there was a despot of the Morea, of Serbia, etc. At present, despot means an absolute ruler, as the emperor of Russia; but, in a narrower sense, it conveys the idea of tyranny, as in fact the possession of absolute power and the abuse of it are two things bordering very closely on each other.

**Despoto Dagh**, *dēs pō tō dāh*, a mountain chain of European Turkey, extending from 30 miles to the east of the Balkans to the bank of the Maritza.

**Dessaix, Joseph Marie**, *zhō-zěf mā-rē dā-sā*, French general: b. Thonon, Savoy, 24 Sept. 1764; d. 26 Oct. 1834. He served at the siege of Toulon, and in Italy under Bonaparte; was elected in 1798 to the council of 500, where he opposed the *coup d'état* of the 18th Brumaire. He was made a brigadier-general by Bonaparte in 1803, and, in the campaign of 1809 against Austria, a general of division, receiving from the emperor the surname of *L'intrepide*, and the title of count of the empire.

**Dessalines, Jean Jacques**, *zhōn zhāk dā-sā-lēn*, emperor of Haiti: b. 1760; d. 14 Oct. 1806. He took the name of the person in whose service he remained until 1790; after that time he fought under Blasson, and, still later, joined Toussaint L'Ouverture. In his struggle against Gen. Rigaud he signalized himself as much by his cruelty as his bravery. In 1802 he surrendered to Gen. Leclerc. But when an epidemic of yellow fever fell upon the French army and almost annihilated it, he attacked Rochambeau with an army of 30,000 blacks, thus obliging the French commander to surrender to the English, and to leave the island (1803). In 1804, when governor-general of Haiti, he issued an order for the general slaughter of the white inhabitants. In October of the same year he was proclaimed emperor, and made an unsuccessful attempt to take the city of Santo Domingo in March 1805. Incurring the enmity of his own followers, he was killed in an ambuscade near Port au Prince.

**Dessau**, *dēs'sow*, Germany, capital of the duchy of Anhalt, in a valley on the Mulde, on the railroad between Berlin, Köthen, and Leipsic. The principal building is the ducal palace, built in 1748, containing both a picture-gallery and a library, in which are numerous MSS. of Luther. The manufactures consist of woolen and linen cloth, hats, leather, tobacco, musical and other instruments. The ground around Dessau, originally a sandy waste, has been completely reclaimed, and is now covered with beautiful gardens. Pop. 42,375.

**Dessicants**, in medicine, substances that check secretions from mucous membranes or cause cicatrization. See **ASTRINGENTS**.

**Desterro**, *dās-tār'rō*, also called officially **Florianopolis**, Brazil, the capital of the state of Santa Catharina. It is situated on a long and narrow island near the mainland, and its foreign trade passes through the port of São Francisco, which is one of the best on the coast of southern Brazil. During the revolt of the navy in 1893, the most critical period through which the new Brazilian institutions have passed, Desterro and its port were head-

quarters of the rebellion. Pop. (1903) estimated 15,000.

**Destouches, Philippe Néricault**, *fā-lēp nā-rē-kō*, French dramatist: b. Tours, France, 22 Aug. 1680; d. near Melun, France, 4 July 1754. His comedy, 'The Boaster' (1732), is a masterpiece in matter, in elaboration, and in character delineation; Lessing classes that work, with its companion piece, 'The Spendthrift' (1736), as "models of the finer high comedy." Hardly inferior to these is 'The Married Philosopher' (1727), largely based on the author's own life.

**Destroying Angels**. See **DANITES**.

**Destutt de Tracy, Antoine Louis Claude**, *ān-twān loo ē klōd dā-stūt dē trā-sē*, COUNT, French philosophical and metaphysical writer: b. Paris 20 July 1754; d. there 10 March 1836. Though in repeated peril during the French Revolution, he survived to write 'Elements of Ideology' (1817), a development of Condillac's philosophy, and in part an exposition of what then passed for economics. His 'Delineations of the Politics of the World's Nations' (1820), and prior works, received considerable notice in the United States through Jefferson, who translated the 'Commentaire sur l'Esprit des Lois' (1806) into English and had it published in Philadelphia (1811).

**Desulto'res** (from *desilio*, "I vault"), the Latin name for vaulters or leapers, who jumped from one horse to another. The Scythian, Indian, and Numidian cavalry were very expert desultores, and each man carried at least two horses to the field. When one was weary he jumped with great agility upon another, which he led by his hand. The Greeks and Romans introduced the same practice in their games, races, and funeral solemnities, but never, as far as we know, in war. Homer describes a vaulter of this sort who performed his feats on four horses at once (Iliad, xv. 679); and Livy (xxiii. 29) describes a kind of Numidian cavalry in Hasdrubal's army in Spain, in which the soldiers had two horses each, and in the heat of an engagement frequently leaped, fully armed, from one to another. Ælian gives a similar account of a tribe dwelling not far from the Danube, who, on this account, were called *Amphippi*.

**Detachment**, a body of troops or part of a fleet selected from the main body for some special service.

**Detaille, Jean Baptiste Edouard**, *zhōn bāp-tēst ēd-oo-ārd, dē-tā-yē*, French painter: b. Paris 5 Oct. 1848. He is distinguished for his treatment of battles and military subjects. One of his best pictures, 'The Passing Regiment,' is in the Corcoran Art Gallery in Washington, D. C.

**Detective**, one who searches for criminals or ferrets out crime. The work of the detective is allied to that of the police, and wherever a police force exists there is some detective work to be done, though only in connection with a large police force are men regularly assigned to detective work. The police force of New York includes a body of men known as detective sergeants, who have charge of the work of looking for criminals or investigating such crimes as seem to call for their services. The United States government maintains a force,

## DETERMINANT — DETERMINATIVE MINERALOGY

known as Secret Service men, whose principal duties consist in unearthing counterfeiters, and those who rob the mails or infringe the revenue laws. The British government has established in London a force of detectives known as Scotland Yard men.

There are private detective establishments in all large cities, the best-known of these being the Pinkerton bureau, which has offices in several cities of the United States under the style of the Pinkerton National Detective Agency. This agency and similar bureaus make a business of supplying detectives to any one who will pay for the work, usually to get evidence in civil or criminal suits.

The detective achieves success by studying the ways of lawbreakers, and becoming acquainted with the haunts of the men he seeks. For instance, William Pinkerton, of Chicago, made an exhaustive study of the class of tramps who rob country stores and post-offices, and blow off the doors of safes. Their own name for their class is "yeggmen," and the only way to know them thoroughly is to become one of them for a time, to live as they do, and thus secure their confidence, and gain familiarity with their system of exchanging information. These yeggmen had a habit of registering on the tank houses of railway stations, where they would write the names by which they were known, with the date, and the direction they were going. Doubtless this practice has changed for some other, since the detectives became familiar with it, and used their knowledge to lodge various bad characters behind the bars.

Those detectives who achieve the best results make a specialty of one line of work, with which they become perfectly familiar. In a city like New York there is on the detective force at least one man familiar with the ways of each of the principal classes of crooks. If a pick-pocket is wanted, the man familiar with that work is supposed to have a pretty good idea what pickpockets are in town, and where they can be located; if he be an extra good detective, he will also be able to form a judgment from the nature of a steal, who are most likely to have been the thieves. It is this sort of knowledge that makes possible the quick detection of criminals.

The nature of detective work is such that very little authoritative matter has been printed about it. One of the first requisites of a detective is the power of keeping silence about the business or the cases on which he works. There are no printed reports and statistics of detective work that could be used in an encyclopædia. Most of the literature is of the nature of detective stories, told to amuse, and concealing instead of making clear real occurrences or facts. The detective at work is really a very different man from what he is pictured in the novel. He has usually had police experience, and is big and strong. These things, with a knowledge of the class of men he is to seek, are his stock in trade. One of the most common and difficult jobs that falls to his lot is the simple following of a man, whom he has located, but whom he does not wish to arrest, until he has traced him to his living place or some haunt where he can also expect to locate some companion or accomplice. To follow a man in an ordinary way is to invite him to escape, for if a crook in a city street

suspects he is followed, he is almost certain to elude the pursuer. The detective who follows one must not stop whenever his man stops, but go right on and appear to pay no attention to him. He must know enough to jump on a car to get ahead of his man, and to be out of view; to dodge through a short-cut if there be one where he cannot lose his man, or to do any one of a dozen things promptly to serve his purpose. It is dangerous to take his eyes off the crook, and equally dangerous to let the crook have a good look at his shadower, so that if the following has to be kept up for any considerable distance it is a very trying piece of work.

The private detective has fallen into some disrepute in the United States, owing to employment on divorce cases or other matters where there is a temptation to manufacture evidence instead of finding it. Some judges have refused to credit the testimony of such detectives unless corroborated. In many cities private detectives are obliged to take out a license before they are allowed to follow the calling.

The Secret Service men whose duty it is to protect the mails have a simple method of locating thieves. Whenever a letter is lost, and a tracer sent after it, and the man found who last had knowledge of the letter, a pin is stuck in a map at the city where the letter was last seen. As more lost letters are searched for, the pins in this map begin to show central points where letters disappear with regularity. This shows about where there is regular thieving, and a detective has his field of work clearly pointed out to him, and by watching the men who handle the mail in that district he is usually sure of locating his man before very long. See also POLICE; SECRET SERVICE.

**Determinant**, in logic, a mark or attribute added to the subject or predicate, which narrows the extent of both, but renders them more definite, or better determined. In mathematics, a name given to the sum of a series of products of several numbers, these products being formed according to certain specified laws. Thus the determinant of the nine numbers:

$$\begin{array}{ccc} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{array}$$

is  $ab'c'' - ab''c' + a'b''c - a'bc'' - a'bc' + a'b'c'' - a''bc' + a''b'c - a''b'c''$ . The different products of which a determinant is the sum are called its "elements." The different quantities which are multiplied to form the elements are called the "constituents" of the determinant. From the upper left-hand to the lower right-hand corner is the oblique line called the "principal diagonal." "The secondary diagonal" is the conjugate line of places. The square root of the number of constituents is the ordinal number of the "order" or "degree" of the determinant.

**Determinative Mineralogy**, that division of the science of mineralogy (q.v.) which treats of the identification of unknown minerals. The expert mineralogist is able to recognize at sight several hundred distinct species of minerals, and many varieties when the specimens brought to his notice are typical. Such ability is the result of much study and experimentation, as well as careful observation of the physical differences between the species. Some times the usually constant properties of certain minerals vary to

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such an extent as to disguise the species. It is then necessary to make such tests as experience has proved are requisite in order to identify the mineral. Though the aid of an elaborate series of determinative tables is usually sought, it is always wise to make a few preliminary tests in order to learn what are some of the most prominent of the physical properties of the mineral. Quite often valuable suggestions as to the character of the mineral, and at times its identity, may be learned by testing its hardness, streak, or cleavage, or by taking its specific gravity, or by observing its crystal form, structure, lustre, color, and feel.

Hardness is a factor of prime importance in the determination of minerals. The number of exceedingly hard minerals is very small. If a mineral is not scratched by topaz, it must be some one of a dozen minerals, and these are usually differentiated with ease by other simple physical tests. Ruby is thus separated from garnet, while, if its crystal form is distinct, it may readily be distinguished from the very similar ruby spinel, which is nearly as hard. A knife-blade is all that is needed to prove that iron pyrites, or "fool's gold," is not true gold, for the latter is readily scratched by the blade, while pyrites is not. It is an excellent rule to invariably test the hardness of a mineral before making any other tests.

Streak (q.v.) is of importance with colored minerals and those having metallic lustre. The scarlet streak of cochineal-red cinnabar will instantly distinguish it from cuprite, which has the same color but a brownish-red to blood-red streak. The brown streak of manganite serves to distinguish it from pyrolusite, which has a black streak, while a test of their hardness shows that manganite is 4 and pyrolusite 2 to 2.5. The distinction between gold and pyrite is very marked, gold having a streak of the same color as the mass, while the streak of pyrite is greenish-black. This same greenish-black streak is, however, characteristic of copper pyrites, and its external color is quite similar to that of iron pyrites, but they are readily separated by the superior hardness of the iron pyrites. Such tests as these are not only most convenient in field work, but are at times conclusive. (See MINERALOGY; PHYSICAL CRYSTALLOGRAPHY.)

Cleavage is often an important aid in determinative work. If a lead-gray mineral of metallic lustre shows well-developed cubical cleavage, it may be safely assumed that it is galena. If a transparent mineral cleaves readily into octahedrons of large size, it is almost certainly fluorite. Sphalerite is the only mineral in which dodecahedral cleavage is highly perfect, while the excellent rhombohedral cleavage of calcite instantly distinguishes it from quartz, which it often resembles, and the separation is made conclusive by testing the hardness, which in calcite is 4 and in quartz 7.

Crystal form is one of the most important determinative factors. The characteristic cross twins of staurolite suffice to determine that species, which it would be difficult to recognize if massive. The trillings of cerussite easily separate it from anglesite, whose physical properties are very similar. Many of the zeolites and their common associates are recognized by their crystal form; thus analcite is isometric and generally in trapezohedrons, chabazite is

rhombohedral, apophyllite is tetragonal. The "gridiron" structure of microcline as seen in thin sections under the microscope, which is due to twinning, serves effectually to differentiate it from all of the other feldspars. The importance of a knowledge of crystallography (q.v.) as an aid in determinative mineralogy cannot be overestimated.

Specific gravity is one of the least variable properties of minerals. Its accurate determination, therefore, may be the only test needed to positively identify a specimen. This fact is of immense importance to the jeweler, who constantly resorts to his specific gravity balance as his safest test for precious stones. Gold, too, may be thus identified, for no other yellow mineral has a specific gravity approaching it. Even the rough test of placing the unknown mineral in the palm of the hand and comparing it with about the same quantity of a known species may be suggestive as to the identity of the mineral. Thus rusty-yellow quartz sand may be instantly distinguished from the very similar but much heavier monazite sand.

While the examination of the physical properties of an unknown mineral, as above suggested, is of great value, there is but one way in which its identity can be fixed in all cases, and that is by the use of a series of determinative tables in which the mineral is referred successively from one large group to a smaller, until finally all have been eliminated but itself. The process is based largely on a series of chemical tests which, in almost all cases, give an insight into the character of the material. The scheme involves (1) the heating of a fragment in the forceps; (2) heating in a closed tube; (3) heating in an open tube; (4) heating on charcoal in the blowpipe flame; (5) fusion with fluxes on platinum wire. These processes are described under BLOWPIPE ANALYSIS (q.v.).

While described species may be determined by the foregoing methods, it is at times desirable, and in the case of new species essential, to ascertain the exact proportions of the various ingredients which are present in the mineral; for this purpose it is necessary to resort to a complete quantitative analysis. See CHEMICAL ANALYSIS.

*Bibliography.*—Penfield's revision of Brush's 'Manual of Determinative Mineralogy'; Endlich, 'Manual of Qualitative Blowpipe Analysis and Determinative Mineralogy'; Frazer, 'Tables for the Determination of Minerals by Physical Properties'; Crosby, 'Tables for the Determination of Common Minerals.'

GEORGE LETCHWORTH ENGLISH,  
*Mineralogist, New York City.*

**Determinate Problem**, a problem in geometry which admits of a limited number of solutions, an indeterminate problem admitting of an indefinite number of solutions.

**Determinism**, a name applied by Sir William Hamilton to that system of philosophy which holds that the will is not a free agent, but is irresistibly determined by providential motives, that is, by motives furnished by Providence, which turn the balance in our mental deliberations in accordance with its views. Determinism is often mistakenly confused with materialism and atheism. It does not deny moral responsibility though holding a man cannot choose to act in a certain way while he



prefers with his whole nature to act in another way. This doctrine of the necessitarian philosophers expounds in short that whatever happens is entirely determined by antecedent causes.

**Detlef, Karl**, kārīl dēt'lēf, pseudonym of Klara Bauer, German novelist: b. Swinemünde 23 June 1836; d. Breslau 29 June 1876. Her 'Indissoluble Bonds' (1877) and 'Must It Be?' (1872), are valuable and engrossing studies of character.

**Detmold, dēt'möld**, Germany, city, capital of Lippe, on the Werra, 50 miles southwest of Hanover. It consists of an old and a new town, the former poorly, the latter regularly built. Its principal edifice is the palace, a fine old castellated building, with a vast round donjon tower. In the vicinity, on the Grotenberg, the loftiest summit of the Teutoburger Wald, a colossal statue, 45 feet high, placed on a solid circular pedestal twice that height, has been erected to the Hermann or Arminius who overthrew Varus and his legions. Pop. 11,542.

**Detonating Powder**, certain chemical compounds, which, on being exposed to heat or suddenly struck, explode with a loud report, owing to one or more of the constituent parts suddenly assuming the gaseous state. A mixture of equal volumes of chlorine and hydrogen exposed to direct sunlight detonates violently, forming hydrochloric acid gas. The chloride and iodide of nitrogen are very powerful detonating substances. The compounds of ammonia with silver and gold, fulminate of silver and of mercury, detonate by slight friction, by means of heat, electricity, or sulphuric acid. The compound used in the priming of percussion-caps and fuses is the fulminate of mercury or silver, collected as a precipitate when the metal, dissolved in nitric acid, is poured in warm alcohol and then collected, washed, and dried.

**Detonators** are the devices used in firing high explosives by detonation. They consist of small cylindrical copper tubes closed at one end and charged with mercuric fulminate or a mixture of mercurial fulminate and potassium chlorate which is compressed in the bottom of the tubes. Those used for blasting in mines and quarries are also known as blasting caps and exploders. They are rated as single force, double force, triple force and so on, the charge for the single force cap being about five grains of the detonating substance and the charges for the higher force increasing about two grains for each grade. To fire them a piece of Brickford or "running" fuse of the desired length is inserted in the mouth of the detonator or cap and then the copper tube is bent or "crimped" securely about the sides of the fuse. The detonator is inserted in the bore hole so as to come in close contact with the first cartridge or "stick" of explosive and the bore hole is filled with tamping. When a flame is applied to the end of the fuse that projects from the bore hole, the column of powder in the fuse takes fire, the fire travels slowly down to the charge in the detonator, causing the detonation of the dynamite.

For military mines and naval torpedoes and, to a considerable extent, for commercial blasting, detonators to be fired by an electric current are employed. These are known as electric detonators. They differ from those previously described only in that the mouth of the copper

cap is closed by a plug made of sulphur and ground glass, through which two copper wires, known as the "legs of the detonator," are led. Inside the cap these wires are bridged over by a very fine wire made of an alloy of iridium and platinum. Around the bridge and between it and the fulminating composition is placed a layer of meal gun-cotton. When it is desired "to fire," the legs of the detonator are connected with a dynamo-electric machine and the current generated. As the current passes it heats the bridge to incandescence, which sets fire to the gun-cotton; this causes the fulminate to detonate, and this detonates the charge of dynamite or other high explosives. The electric detonators used in the United States navy contain 35 grains of mercuric fulminate, this large quantity being used to make sure that the detonator will do its share of the work in torpedo attacks on an enemy. See DETONATING POWDER; EXPLOSIVES.

**Detritus**, applied in geology to accumulations formed by the disintegration of rocks, may consist of angular and sub-angular debris, or of more or less water-worn materials, such as gravel, sand, or clay, or an admixture of these. Especially applicable to that fragmentary matter which if consolidated into a solid would form what is known as breccia.

**De Trobriand, dē trō-brā-ān, Philippe Regis**, BARON, American soldier: b. Tours, France, 4 June 1816; d. Bayport, Long Island, 15 July 1897. He was educated at the University of Orleans, studied law at Poitiers, and came to the United States in 1841. He was commissioned colonel of the 54th Volunteers in the Civil War 1861; and was appointed brevet brigadier-general in 1867. He was editor and publisher of the 'Revue du Nouveau-monde,' New York, 1849-50, and joint editor of the 'Courier des Etats Unis' 1854-61. Among his works are: 'Les Gentilshommes de l'Ouest' (1841); 'Quatre ans de campagnes a l'Armee du Potomac' (1867).

**Detroit** (Fr. *détroit*, strait), Mich., capital of Wayne County, in the southeast; largest city of the State, and of the entire Northwest to the Pacific; 13th of the United States; on the northwest bank of the Detroit River dividing the United States from Canada, one end six miles below Lake St. Clair and the other about 14 from Lake Erie. It is 88 miles from Lansing, the State capital; 284 from Chicago; 60 from Toledo, Ohio; 251 from Buffalo; and 291 from Mackinaw. Pop. (1900) 285,704; (1903) about 325,000.

Detroit has the finest harbor on the Lakes; the river, on the city front, is often called "the Dardanelles of America." The broad outlet of Lake St. Clair, running west and dividing around Belle Isle, narrows to about half a mile and deepens to an average of 32 feet for some miles with a southwest course, before turning directly south, with a current of about two miles an hour. Fed by the Great Lakes, it has always a full stream, neither rising nor sinking much, and is little disturbed by storms; and the largest vessels can lie up to the wharves. Here is built Detroit, extending some seven miles along the river front, lined with wharves, elevators, foundries, warehouses, railroad stations, and freight depots, etc.; and about three miles deep, except in the centre, where it is nearly



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double. Area,  $29\frac{1}{2}$  square miles, but with well-built suburbs outside not yet incorporated; indeed, from Grosse Pointe at the north where Lake St. Clair ends, to Gibraltar at the south where Lake Erie begins, the whole river front for 20 miles is built up with handsome villages, and lined with the summer villas of its wealthy business men, all really part of Detroit. At its southern corner, commanding the channel, is Fort Wayne, an unfinished military post once intended to be the most formidable fortification in the Northwest, and still garrisoned and armed with batteries. Across the river in Canada are Windsor in the centre, the terminal of railroads through Canada, Walkerville on the north and Sandwich on the south.

The ground of Detroit is a gentle slope for 300 or 400 feet back from the river to 20 or 30 feet high; then sinks slightly, and again rises to about 50 feet, and 661 above the sea. The original plan, on a very small scale, was a series of concentric semicircles, or rather segments of polygons, with the Grand Circus—a semicircular park of five and a half acres—as a centre, nearly a mile from the river, toward which they extended. This feature is still preserved; but all the new growth has been laid out in checkerboard system, relieved by a series of noble avenues 100 to 200 feet wide radiating from the river. Jefferson Avenue extends along it; Woodward Avenue runs at right angles to it, dividing the city into halves and the Grand Circus into quadrants; south of Woodward are Michigan and Grand River avenues, at different angles and north is Gratiot. Between the Grand Circus and the river is the Campus Martius, an open space about 600x200 feet, crossed by Woodward and Michigan avenues, and from which start Monroe Avenue, and Fort Street running to Fort Wayne. The streets are generally wide, —50 to 100 feet,—well shaded, and notably clean; some 300 miles of them are paved with brick and asphalt. The chief business street is Woodward Avenue. Jefferson Avenue is another leading one; Griswold Street, with the great banking houses, the custom-house, office buildings, etc., is the Wall Street of Detroit; and others about the Campus Martius are of importance. The chief of the show streets is the Grand Boulevard, a macadamized parkway 150 feet wide and 11 miles long, encircling the heart of the city in a vast sweep from Belle Isle bridge at the east to Fort Street near the western boundary. The outer portions of all the great avenues mentioned, of Lafayette Avenue, and of Fort Street, are full of fine residences; and a notable residence district clusters around Woodward Avenue as it stretches toward Palmer Park.

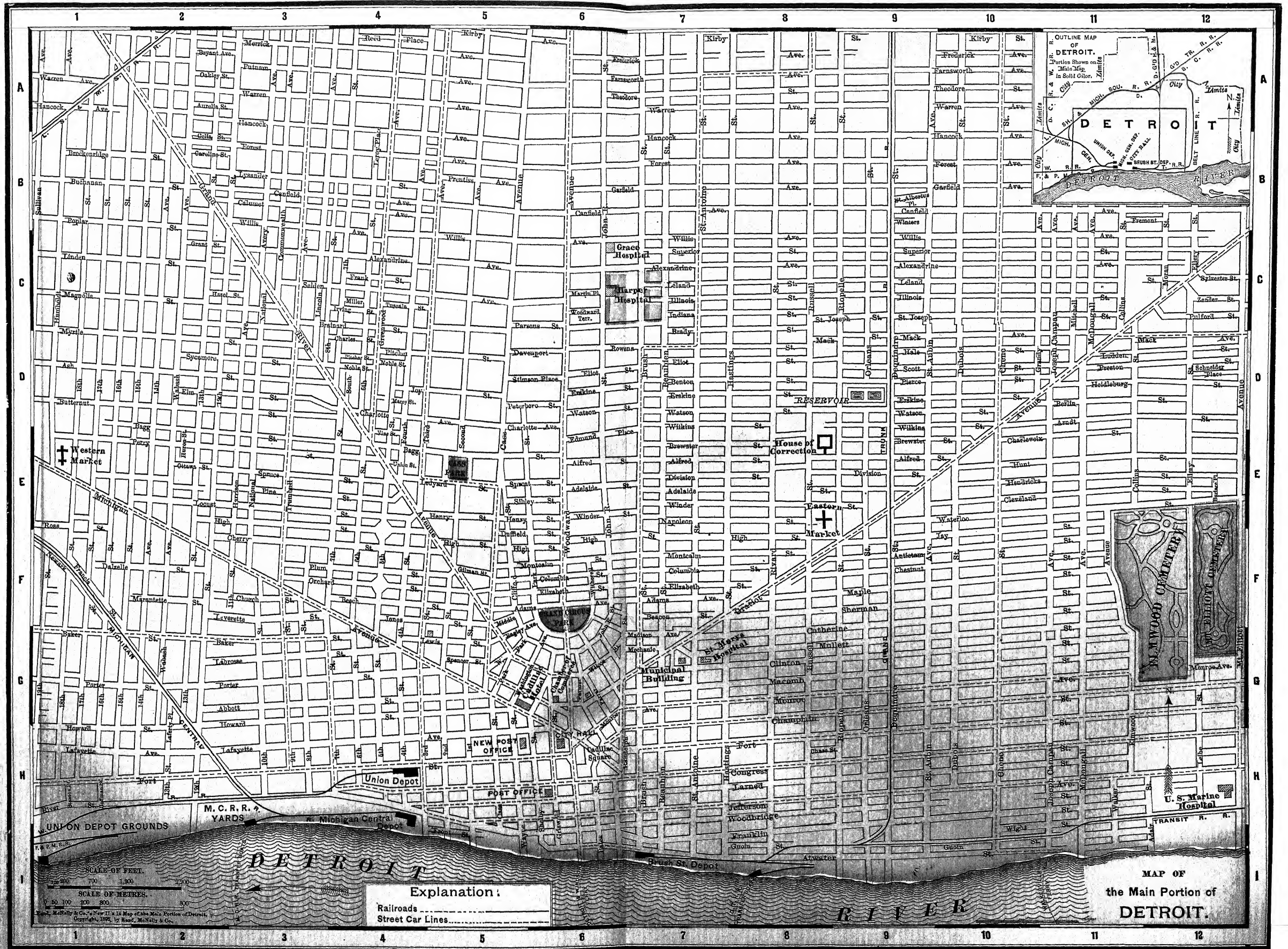
*Public Buildings and Monuments.*—The chief of these are on or near the Campus Martius. Within it, facing the city hall, is the Michigan Soldiers' and Sailors' Monument, by Randolph Rogers, of bronze and granite, 55 feet high, with a colossal bronze allegorical statue of Michigan on the summit; it cost \$75,000. On the west, facing four streets, is the city hall, three stories and mansard, of sandstone in the Italian style; 200x90 feet, 66 feet high to top of cornice, 180 to top of tower; it cost \$600,000, and is one of the finest in the West. Near by are the handsome Wayne County court-house, the largest public building in the city, and the splendid Majestic office building. On the north

of the Campus is the Detroit Opera House. The custom-house occupies the old post-office, on Griswold Street, and the magnificent new post-office is on Fort Street, west of the City Hall. The Chamber of Commerce, the Athletic Club, and Y. M. C. A. buildings, the House of Correction, and the magnificent passenger stations,—the Michigan Central, and the new Union station at Fort and Third,—are all conspicuous. The churches will be mentioned later.

*Public Service and Improvements, etc.*—The city is exceedingly well sewered, and its death rate is very low,—12.03 per 1,000 in 1901. The water supply is taken from a crib in Lake St. Clair, 1,500 feet out, at a depth of 46 feet; the system has over 600 miles of pipes, and has cost above \$6,000,000. It is supported partly by rates, and partly by a city tax. The electric lights are partly arc lights on high towers; there are about 1,800 in all. The electric railway system has over 200 miles of track within the city limits, and over 300 in suburban lines outside to every quarter; and ferries run to Windsor and Walkerville in Canada. There is a bridge over the American half to Belle Isle, but none over the full stream. There are three railway passenger stations,—the Union, the Michigan Central, and the Brush Street, all on the water front not far apart. The fire department has 27 steam fire engines, 6 chemical engines, 10 hook and ladder companies, 6 supply wagons, 2 fire boats, and a water-tower; besides reserve engines, etc. There are 434 fire-alarm boxes and 3,427 hydrants. The police system has seven precinct stations and six sub-stations, a signal office, and a harbor-master.

*Parks, Pleasure Resorts, Public Amusements, etc.*—Detroit has 21 public parks; besides a number of small triangular squares caused by the intersection of the radiating avenues with the streets, often with fountains. The largest, and the principal public resort, is Belle Isle in the river, whose entire 707 acres have been parked with great beauty at a cost of over \$1,500,000, including a ring of little lakes and canals. It is reached by a handsome iron bridge built in 1889, at a cost of \$315,000; and is to be increased 100 acres by taking in the southwestern shoals. The next largest is Palmer Park, of 141 acres, on Woodward Avenue, about  $6\frac{1}{2}$  miles from the river, sedulously made a colonial museum; it has a colonial log house, and a most interesting collection of colonial and other historical relics, besides a colonial casino. Clark Park in the west has about 25 acres; Voigt Park  $8\frac{1}{2}$ ; and the Grand Circus, in each of whose quadrants made by Woodward Avenue there is a fountain,  $5\frac{1}{2}$  acres. Besides these, there are opportunities for delightful summer trips on the river and lakes; and the river is dotted with charming places where excursion steamers run, from Grosse Pointe, on Lake St. Clair, famed for its cherry orchards, to Grosse Isle where Lake Erie opens. There are nine theatres and opera houses in the city, the largest of which are the Detroit and Whitney's opera houses, and the Lyceum. The finest cemeteries are Elmwood (Protestant) and Mt. Elliott (Catholic) side by side on the north-east, about two miles from the centre, beautiful in keeping and monuments; and Woodmere, some four miles to the southwest on high ground, is another beautiful one. Woodlawn,







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1. Cadillac Square; County Building and Soldiers and Sailors' Monument.
2. Belle Isle Park; The Grand Canal.





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a new and beautiful cemetery just opened, situated seven miles out Woodward Avenue, and Mt. Olivet, another large (Catholic) cemetery about seven miles out at the northeast. There are a number of Lutheran and Jewish cemeteries.

*Schools, Libraries, Newspapers, etc.*—In 1902 the public school system had 72 buildings, 66 brick and 6 wood, besides a central office building; and 3 high schools. There are, in addition to the above, 56 private schools in the city. Total number of teachers employed, 1,288; total number of children of school age, 83,215; total number of children attending school, 51,554; and the expenditures were \$1,286,708. There is no Protestant nor non-sectarian institution for general higher education, the University of Michigan at Ann Arbor being only 37 miles away; but the Jesuits have Detroit College, opened 1877. There are also several special professional colleges: three medical, including the Detroit College of Medicine, with schools of pharmacy and dentistry, and Michigan College of Medicine and Surgery, Detroit Homeopathic College, and the Detroit College of Law. There are 82 periodicals, including 7 dailies, 2 of which are German. The one great library is the Detroit Public Library, opened 1865, containing nearly 200,000 volumes, and with branches in each high school as well as several outside. But Andrew Carnegie has offered to give \$750,000 for a library, if the city will expend \$75,000 a year in its support; the offer has not been accepted. The Hurlbut Library at the waterworks is also utilized as a distributing station. The Bar Association has a law library; and the Masonic lodges, the Trades Union Council, and the Museum of Art have also libraries. The latter institution, in part supported by a city tax, has a good collection of historical and archaeological, art, and scientific relics and examples, valued at \$300,000. These include the Stearn's Oriental collection, one of the finest in the country, and the Scripps gallery of old masters.

*Churches and Charities.*—In 1902 there were 200 religious societies in Detroit. The chief denominations were Roman Catholic (36 churches including the cathedral, it being the seat of a bishop), Methodist Episcopal (29), Lutheran (26 of different synods), Baptist (18), Presbyterian (15), German Evangelical (11), Congregational (10). There were also five Jewish synagogues and a temple; and several Catholic convents. Of the church buildings, the largest is the cathedral. Architecturally may be noted Ste. Anne's, and the Convent of the Sacred Heart, on Jefferson Avenue (both Catholic); the First and Fort Street Presbyterian; the Central Methodist; Trinity, St. John's, and Christ (Episcopal); Woodward Avenue Baptist; Church of Our Father (Universalist); First Unitarian; and the Temple Beth El.

The charities include a city poor fund, managed by a commission; and the Detroit Associated Charities. There are four large general hospitals, of which the most noted are Grace and Harper, with training schools for nurses; St. Mary's (Catholic) and the United States Marine Hospital. Besides these are some two dozen allied institutions,—lying-in hospitals, homes for Magdalens, foundlings, and orphans, the aged; etc. The House of Correction, whose buildings, grounds, and appliances have cost some \$600,000, is of world-wide note.

*Commerce and Industries.*—Detroit is a highway through which passes all the commerce between the upper and lower lakes, to the volume of probably 50,000,000 tons yearly, or more than double that of the Suez Canal. It is the terminus of a great number of lake steamer lines, freight and passenger, and a chief calling point for others; and one of the greatest distributing points both by boat and rail between the United States and Canada, with which it does three fourths of its "foreign" trade. In 1902 its exports were \$18,053,055, greatest of all the ports opposite Canada; and its imports \$3,469,077. Of the really foreign trade, extra-continental, the greater part is to England. The exports are grain and flour, swine and their products, cattle, beef, and hides, sheep and wool, and lumber; though the latter trade has greatly declined of late years, as the Michigan pine forests have been stripped. Besides this, it receives and uses or ships east vast quantities of the produce of Michigan, of which it is the natural emporium; wheat, corn, and barley, hops, apples, dairy products, etc., besides those above mentioned. Its annual clearances of vessels are about 3,300, with a gross tonnage of over 500,000. It has the largest dry-dock on the lakes. Besides the water lines, it is the centre of seven great railroad lines, most of them among the chief trunk lines of the West and Canada; the Lake Shore, Michigan Central, Grand Trunk, Canadian Pacific, Pere Marquette, Wabash, and Detroit Southern.

The manufactures of Detroit in 1900 turned out \$100,892,838 in finished product, employing \$71,751,193 of capital and over 51,000 workmen and officials, and paying nearly \$24,000,000 in wages and salaries. The increase from 1890 was 63 per cent in number of establishments, and 30 per cent in value of product: a healthy sign, indicating greater diversity of industries and development of medium businesses. There is a large employment of skilled labor, as in optical goods (\$225,000), professional and scientific instruments, etc. The greatest single item was in foundry and machine-shop products, \$8,943,311; but if we add the allied industry of making the iron and steel itself—over \$3,000,000,—the steamfittings and heating apparatus, and the architectural iron-work, the general iron and steel manufacture will come up to nearly \$15,000,000. Next to this is the manufacture of tobacco products, amounting to over \$6,500,000. Manufacturing chemicals and druggists' products is the third immense specialty, \$4,915,913, the creation or the past 20 years almost wholly. Malt liquors come next. Furniture and carriages, using more skilled work to less stock, have largely supplanted the coarse lumber and planing-mill work once a chief industry. Brass castings are a heavy item; slaughtering and meat packing is important; and paints and varnishes occupy a prominent position.

*Government, Finance and Judiciary.*—The city is divided into 17 wards. The city council has but one chamber, and the council and the mayor are elected for two years. Most of the officials and commissions are elected; some are appointed by the council on the mayor's nomination; and the board of health is appointed by the governor of the State. The finances are regulated by a board of estimates. The city is the seat of the United States circuit court

## DETROIT — DEUS EX MACHINA

for the sixth circuit, the district court for the eastern district of Michigan, the Wayne County circuit court, and local courts. The principal officials of the Lake Survey and the department in charge of the lake lighthouses have their offices here. The city's limit of borrowing is 2 per cent of its assessed valuation; which was about \$250,000,000 in 1902. The tax rate was 2.13, and the amount raised \$5,822,819.44. The net debt was \$3,563,908.74. The banks of the city on 15 July 1901 consisted of 8 national, 14 savings banks, 2 trust companies, and 2 private banks. The joint-stock banks reported \$96,553,247 resources, \$7,850,000 capital, \$2,076,000 surplus, and \$80,221,322 deposits.

*Population.*—Detroit's figures since the first census taken 1820, are as follows: 1820, 1,422; 1830, 2,222; 1840, 9,102; 1850, 21,019; 1860, 45,619; 1870, 79,577; 1880, 116,340; 1890, 205,876; 1900, 285,704. Of these, 189,201 were native born; 96,503 foreign; 4,111 were colored. The total of foreign and those with foreign-born parents was 184,892; and the native white population of native parentage was but 61,309. But as about 32,000 of the foreign-born were English of England or Canada, and others from Scotland, Ireland, etc., the English element is about 100,000.

*History.*—The white man first visited Detroit, so far as records show, about 1655, and the first map of the region was published in 1656. The first settlement was made 24 July 1701, by Antoine de la Mothe Cadillac (q.v.), who had been governor of Michillimackinac, and wished to establish a permanent post for the centre of French power and commerce in the Northwest. He built Fort Pontchartrain, and settled it with 50 soldiers and 50 colonists. At the close of the French and Indian war, on 29 Nov. 1760, Maj. Robert Rogers took the place from the French commandant, Capt. Beletre, by order from the Marquis of Vaudreuil; the garrison were sent off as prisoners, but the Canadian inhabitants were allowed to retain their farms by swearing allegiance to the British crown. The first act of Pontiac's conspiracy in 1763 was to attempt seizing Detroit; but he was foiled, and after a desperate siege from 9 May to 12 October, heroically sustained by Maj. Gladwyn, the post was relieved, alone of all the western forts. In 1778 there were about 300 inhabitants, living mostly in log cabins, with a Roman Catholic Church; in that year the British built Fort Lernault, renamed Fort Shelby by the Americans on obtaining it, which was not till 1796. As part of the Northwest Territory, it came under the Ordinance of 1787, and in 1802 was incorporated as a town, but in 1805 was obliterated by fire except two buildings. It was rebuilt, and became the capital of Michigan Territory. In the War of 1812, William Hull surrendered it to the British under Isaac Brock on threat of a general massacre of the inhabitants by Brock's Indians. Hull was court-martialed for this act. The British, however, evacuated it the next year, and the Americans reoccupied it 29 September. It was incorporated as a village in 1815 and as a city in 1824. It remained the capital of the Territory till 1837, when Michigan became a State; then of the new State till 1847. Detroit celebrated its centennial 24 July 1901. Consult: Farmer, 'History of Detroit and Michigan' (1889), and 'Detroit' in 'Historic Towns of

the Western States' (1901); Burton, 'Cadillac's Village' (1896); Parkman, 'Conspiracy of Pontiac' (1867); 'Landmarks of Detroit,' Ross and Catlin (1898).

C. M. BURTON.

*Author and Historian.*

**Detroit**, Minn., county-seat of Beaker County; on Detroit Lake, and the Northern Pacific Railroad; about 200 miles northwest of St. Paul. The town is the trade centre of a rich agricultural district, and a popular summer resort because of its situation in the beautiful lake region of Minnesota. Pop. (1900) 2,000.

**Detroit River**, a river or strait which connects Lake St. Clair and Lake Erie, and forms part of the boundary between the United States and Canada. *Detroit* is the French word for strait; and the name was given by the French, the first white men who settled here. Its course is nearly south, with slow current, and sufficient depth of water for the navigation of large vessels. It is 25 miles long and three fourths of a mile wide opposite the city of Detroit, where it forms an excellent harbor. The tonnage passing through this river exceeds in volume that passing through any other river in the world.

**Dettingen**, dēt'ting-ën, Germany, the name of several places in Germany, but the only one particularly deserving of notice is a village of Bavaria, on the Main, nine miles northwest of Aschaffenburg. It is noted for the victory gained in 1743 by the English and Austrians under George II. of England over the French under Marshal Noailles, in the war of the Austrian succession.

**Deucalion**, dē-kā'li-ōn, in Greek mythology, father of Hellen, ancestor of the Hellenes or Greeks, was the son of Prometheus and was king of Phthia. The following is the myth with which his name is connected. Zeus, it is said, determining to destroy mankind by water, on account of their impiety, brought a flood upon the earth, by means of a violent rain; Deucalion saved himself and his wife Pyrrha by building a wooden vessel which floated safely to the top of Mount Parnassus. After the flood had subsided they consulted the oracle of Themis to know what they must do to repair the loss of mankind, and were directed to veil their faces and throw behind them the bones of their mother. Understanding their mother to signify the earth, and her bones the stones, they did as the oracle directed. The stones thrown by Deucalion became men and those thrown by Pyrrha became women.

**Deus, Joao de Rogueira Ramos**, zhō-ōwñ roo-jā'rā rā-mōsh dā dā-oosh, Portuguese lyric poet: b. Sao Bartolomeu de Messines, province of Algarve, 8 March 1830. He is regarded by his countrymen as introducer of a new era of Portuguese poetry. National spirit, originality, sensibility, and rhythmic melody characterize his poems. They are published in 'Field-flowers' (1870); 'A Branch of Blooms' (1870); etc.

**Deus Ex Machina**, dē-ūs ēks māk'i-nā ('a god out of the machine'), a Latin phrase used to designate some unknown supernatural cause introduced to explain phenomena that one is not able to account for by natural means; or applied to some extraordinary and unlooked-for agency introduced to solve a difficulty or the like. The phrase is taken from the practice

in the Greek and Roman theatres of introducing a god from above by means of some mechanical contrivance whenever it was necessary to cut some dramatic knot which could not be loosed by the human actors.

**Deuteronom'y** (Gr. *deuteronomion*, the duplicate law, or duplication of the law, from *deuteros*, "second," and *nomos*, "a law"), the last of the books of the Pentateuch, so called from its consisting in part of a restatement of the law as already given in Exodus, Leviticus, and Numbers. It contains also, in addition to special commands and admonitions not previously given, an account of the death of Moses. This book presents the third and latest phase of the development of the Mosaic legislation. Its great aim is to check the encroachments of idolatry, and to concentrate the national worship in the great sanctuary at Jerusalem, especially at the three annual festivals. It is instinct with the prophetic spirit, and lays stress on the great commandment to love and fear God with the whole heart as the sum of the law. It is supposed by many critics that the book of the law found by Hilkiah, the high priest, in the house of the Lord during Josiah's reign (II. Kings xxii. 8-13) consisted of the larger portion of Deuteronomy. It may be divided into (1) four parting addresses of Moses to the Israelites in the plains of Moab, ch. i.-xxx.; (2) the charge to Joshua and to the priests, with the committal of the book of the law to the keeping of the latter, and his song, xxxi.-xxxii. 47; and (3) three appendices, namely, (a) announcement to Moses of his approaching death, xxxii. 48-52, (b) the poem conveying his blessing on the tribes of Israel, ch. xxxiii., and (c) an account of his death, ch. xxxiv. The authorship of this book has been traditionally assigned to Moses, with the exception of the few concluding verses which narrate his death, and which by many of the conservative school of theologians have been ascribed to Ezra. Of late years much critical labor has been bestowed on this and the four preceding books, constituting the Pentateuch, and the Mosaic authorship of the whole has been both assailed and defended with considerable learning and ability. See PENTATEUCH.

**Deutoplasm.** See EMBRYOLOGY.

**Deutsch, doich, Emanuel Oscar Menahem,** German Orientalist: b. Neisse, Silesia, 28 Oct. 1829; d. Alexandria, Egypt, 12 May 1873. His education was obtained at the University of Berlin and in 1855 he went to England to fill an appointment in the library of the British Museum, where for 15 years he studied and wrote. He is best known by his brilliant article on the 'Talmud' in the 'Quarterly Review' (1867), to which he also contributed an article on 'Islam' (1869). He was a valued contributor to the first edition of Chambers' 'Encyclopædia,' for which he wrote nearly 200 articles. A volume of his 'Literary Remains,' with sketch of his life was published in 1874.

**Deutsch, Gotthard,** American Hebrew scholar: b. Kanitz, Austria, 31 Jan. 1859. He was graduated from the University of Virginia in 1881. He is professor of Hebrew at Union College, Cincinnati. Besides his scholarly works, 'Symbolik in Cultus'; 'Theory of Oral Tradition'; and 'Philosophy of Jewish History,' he has published 'Andere Zeiten,' a novel.

**Deutz,** doits, Prussia, town in the province of the Rhine, on the river Rhine, opposite the city of Cologne, with which it is now incorporated. It is connected with Cologne by a bridge of boats 1,400 feet long. It is strongly fortified, as part of the defenses of Cologne — forming, in fact, a tête-du-pont. Deutz is a very ancient place, and is said to owe its origin to a castle built on its site by Constantine the Great. Pop. 17,782.

**Deutzia,** doit'sī-a or dūt'sī-a (so named in honor of the Dutch botanist Deutz), a genus of plants of the natural order *Saxifragaceæ*, containing seven or eight species, all of which are interesting for the beauty of their flowers. Some of the species are cultivated in America as hothouse flowers, or ornamental shrubs. The nearest relatives growing wild in the United States are the syringas. The deutzias are small shrubs indigenous to China and Japan, and northern India. They are covered with stiff, stellate hairs, on which account one species (*D. scraba*) is used by joiners in Japan to polish wood. The flowers are arranged in thyrsi like the lilac.

**Deux-ponts, dè-pôn,** the French name for the German town of Zweibrücken, in Latin *Bipontium*, all which names signify two-bridges. There was formerly a county of this name, which took its name from this town, which is now in the Bavarian Palatinate. It was afterward erected into a duchy. By the Peace of Lunéville (1801) the duchy was ceded, with all the left bank of the Rhine, to France, and afterward composed a part of the department of the Donnersberg. It contained 70,000 inhabitants, on 760 square miles. By the peace of 30 May 1814 it was restored to Germany. See ZWEIFRÜCKEN.

**Deva, dā'vā** (Lat. *deus, divus*), among the Aryans in general, an epithet of divine persons and things; hence often opposed to the *dev* of the Parsees. It is commonly applied to the goddess Durgā, the wife of Siva, of terrific form and irascible temper. Devakātmajā is the mother of Krishna, who is also named Devākī. Devatarū is the holy fig-tree, belonging to Sverga or paradise. Devatā denotes a deity; Devadatta, the younger brother of Buddha, who is called Devadattārāja (Deodatus senior). Devadeva is a name of Brahma; Devapati is Indra, the god of the sky; Devayajna is the Homa or burnt sacrifice; Devarishi a celestial saint. There are a great many classes or choirs of inferior devatās, who are ministers to the higher gods, such as the 12 Adityas or forces of the sun; the Maruts or winds, the celestial musicians; in short, endless motley hosts with variable attributes. See BRAHMA.

**Devanāgarī, dā-vā-nā'ga-rē** (lit. "townscript of the gods"), the character most widely understood by Hindu scholars, in which Sanskrit works are usually printed, unless when in Roman letters. See SANSKRIT, ALPHABET.

**Devaprayaga, dā-vā-prā-yā'gā,** or **Deoprayag,** India, a sacred city of the Hindus, in the district of Garhwal, Northwest Provinces, on a mountain side, 2,266 feet above the sea, in the fork of the Alaknanda and the Bhagirathi, which join to form the Ganges. Devaprayaga possesses a notable temple, and is a favorite place of pilgrimage.

## DEVELOPING IN PHOTOGRAPHY — DEVELOPMENT HYPOTHESIS

**Developing in Photography.** See NEGATIVES, DEVELOPMENT AND TREATMENT OF.

**Development**, when joined with the word theory has often been used as a synonym for the term evolution, to denote the slow and gradual process by which, according to natural laws, animals and plants have passed from lower and simpler forms to higher and more specialized organisms. When used alone the word is employed in biology to signify the successive and more rapid changes which plants and animals undergo in passing from the embryo to the adult stage of individual life. This restriction is here observed in treating of development in animal life illustrated by examples shown in the accompanying plate. The changes taking place in the egg, or in the fetus within the body of the parent, are described under EMBRYOLOGY.

After leaving the egg stage, or having been separated from the body of its parent, the animal is either complete in its organization, like the parent, or it passes through successive larval stages before it reaches the perfect form of adult life. A remarkable fact about the larval stages is that the organs are adapted to the necessities of each change in the development, so that the young may live to perpetuate the species, even though the parents die. Familiar illustrations of these transformations are recognized in the youthful period of butterflies and bees. But there are lower grades of animal life, in which the metamorphoses of the young are no less striking.

Among the crinoids, of the branch *Echinodermata*, which includes the starfish, is a genus lily-like in appearance which, as soon as the embryo is hatched from the egg, consists of little more than a mouth surrounded by hair-like processes called cilia. These delicate organs resemble eyelashes and are the forerunners of legs, fins, and wings in animals of more advanced types. In the young crinoid they are used for swimming and for drawing food into the mouth. Within a few days after it is set free in the water, this larva develops a calcareous stem surmounted with a cup or calyx and attaches itself to some object on the sea bottom. Soon afterward the calyx opens and expands like the sepals of a flower; long, arm-like tentacles grow out; the stem breaks off, and the adult crinoid becomes again a free swimmer. (See Plate 6, 6a.)

Higher in the scale of animal life, in the class *Crustacea*, are the *Cirripeds* (curly-hair-footed) or barnacles. The adult is covered with a head-like shell, within which are contained the organs—the digestive apparatus, the double eye, and the numerous feet. Some barnacles by a fleshy peduncle attach themselves to a rock or to the bottom of a ship; others are attached by their sucking antennæ. In this sessile or stalked condition the barnacle opens its shell, and by the vibration of its feet captures its food, or again closes its shell to avoid danger. But after the hatching of the embryo, the larva, floating in the water, has but three pairs of feet, a pair of horns, a single eye, and a shield covering the back. This is known as the *nauplius* stage. After several moults, each accompanied by a change of structure, it enters the *Cypris* stage. The bivalve shell replaces the larval shield, and seven pairs of appendages are added. This free-swimming stage is of short

duration, and the animal fastens itself to some fixed object or to a sailing vessel. (3, 3a.)

The inhabitants of the water, like those of the land, are often infested with parasites. Of these the crustaceans furnish a large number. These enter as unwelcome guests the bodies of starfishes, ascidians (4b), and of many other sea animals. They inhere in the skin of fishes and cetaceans, or like the cirriped, the peltogaster, attack the unprotected part of the hermit crab. The larvæ of these pests quit the egg in the partly developed stage of *nauplius*, and through numerous moultings reach the adult form. The female often surpasses the male in the number of these changes, and is the larger of the two. (5, 5a.) Passing to the Crustacean Decapoda—the shrimps, lobsters, crayfish, and hermit crabs—the embryo stage of development is much more advanced than that of any other of the groups already mentioned. These long-tailed crabs are characterized by 20 segments of the body, and 19 pairs of appendages. The embryo-shrimps break the egg in a more complete form known as *zoea*—a stage which includes the carapax and the first four pairs of appendages. A second stage produces the five pairs of locomotive feet attached to the thorax, and the six pairs of egg-supporting feet joined to the abdomen. (2, 2a, 2b.)

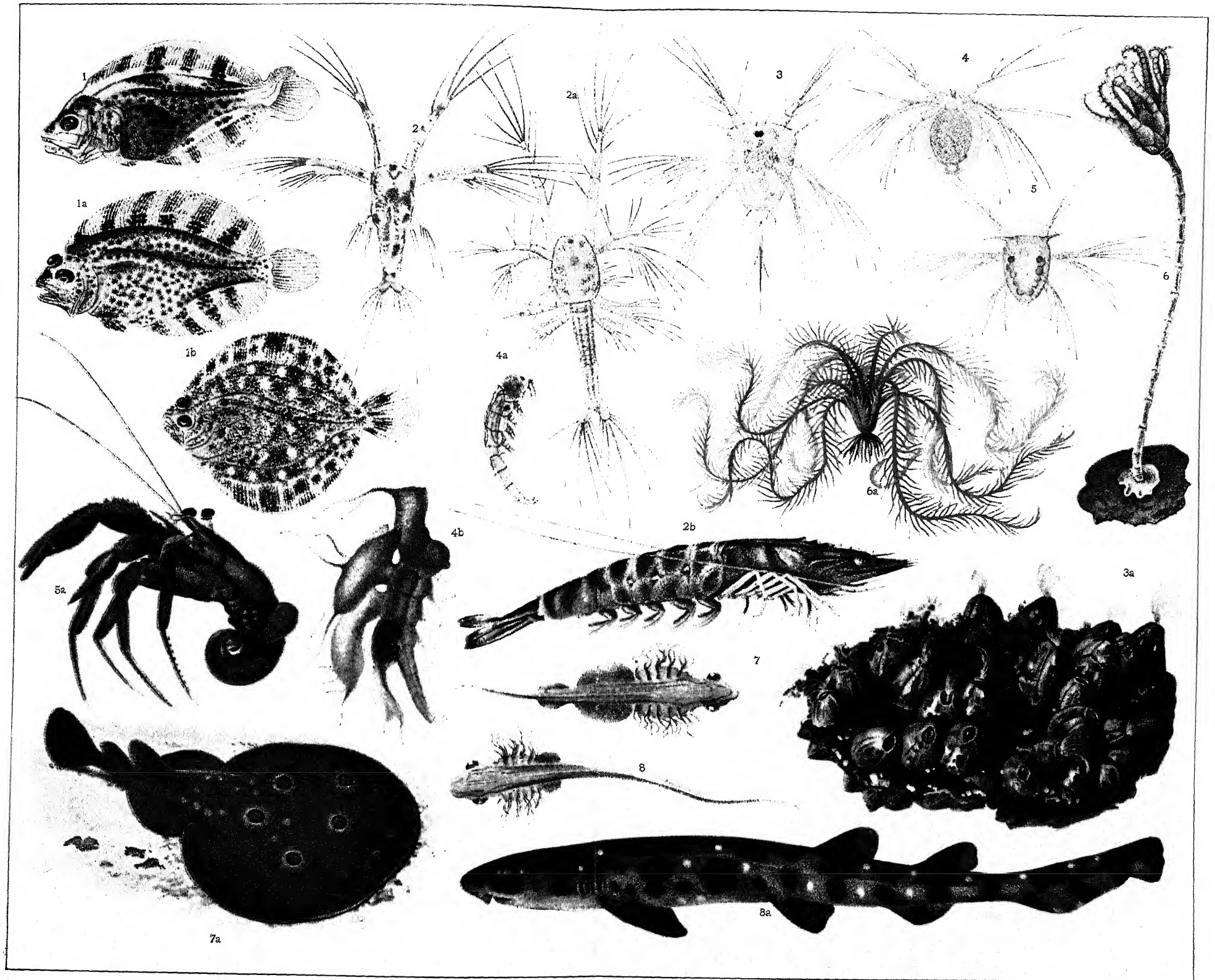
Among the lowest forms of *Vertebrata* are the class *Elasmobranchii*, including sharks and skates. Interest in these animals is directed to the difference between their appearance and their structure. They look like fishes, but they are not strictly such. Their skeletons are not bony, but are cartilaginous. While the form of the adult points forward to the teleosts, or true fishes, the young shark, as the dogfish, and the young skate, as the torpedo, both in their form and structure point back to the higher invertebrates, the shrimps and crayfish. In form and in swimming organs these larvæ are similar and suggest the lower kinship. Yet the one develops into the elongated body of the dogfish with ordinary-fish like pectoral fins (8, 8a), and the other changes into the broad, flattened shape of the torpedo, with exaggerated pectoral fins scarcely distinguishable from the body (7, 7a).

In the sub-class *Teleostei*, or perfect-bone fishes, the group of *Heterosomata*, or flatfishes, including the English turbot and plaice, and the American halibut and flounder, present striking changes in development. At the stage of birth, and for some time afterward, the young show the bilateral symmetry common to other teleost tribes, swimming with their broad side vertical, an eye on each side. Gradually there is a tendency to lean to one side, which increases; the skull twists the other way, the under eye goes with the head, until a complete readjustment has been effected, and the fish swims with its flat surface parallel with the sea bottom and with its two eyes looking upward. (1, 1a, 1b.)

**Development Hypothesis**, in biology, the hypothesis or theory that species were not each of them a separate creation, but by some process, or other came from previous species, the only exception, if any, in existence, being one or more primordial forms. By a similar process, arose also the greater differences of structure, according to this theory, which distinguish genera, families, orders, classes, and even higher



# DEVELOPMENT OF ANIMALS.



1, 1a, 1b. Various stages of the Turbot. 2, 2a, 2b. Development of the Shrimp. 3. Free-swimming form, and 3a, Sessile form of Barnacle. 4, 4a. Forms of a Nautopterus. 4b. Female living in body of an Ascidian. 5, 5a, Forms of a Peltogaster. 6a. Forms of a Crinoid. 7, 7a. Torpedo embryo and adult. 8, 8a. Embryo and adult Dog Fish.





## DEVENS—DE VERE

groups. Man comes into the world as an infant, and bodily and mental development, operating by means of changes so gradual as to escape notice at the time, make that infant successively pass through childhood, youth, and so on to full maturity. Growth, still continuing, is now less apparent than before, and finally counter causes arrest and overcome it and induce decline.

Similarly, plants grow from seeds; the oak being ultimately produced by the acorn. Thus development is the law of the individual, both in the animal and in the vegetable kingdom. Among the several races of mankind there is a tendency toward progress from a less to a more civilized state, which again is development in another form. If it is manifested in the individual and in the human, if not even in all species, the inquiry, according to the upholders of this theory, is inevitable. May it not also operate in the various genera, families, orders, etc.? May not the more highly organized animals and plants have in some way been developed from the lower ones, and the time-honored view that species—each of them a separate creation—are so nearly constant that they can run only into varieties, require modification?

Buffon, in a vacillating way, believed in the transformation of species. Lamarck strongly contended for the same view, first publishing his opinions on the subject in 1801; stating them at greater length in 1809 in his *Philosophie Zoologique*, and in 1815, in the introduction to his *Hist. Nat. des Animaux sans Vertèbres*. He maintained that all species, man himself not excluded, had descended from other species existing at a prior time. As early as 1795 Geoffroy Saint-Hilaire suspected that all known species are degenerations of one primitive type; he did not, however, publish his views till 1828. In 1844 appeared a work called *Vestiges of the Natural History of Creation*, which by 1853 was in its 10th edition, and strongly advocated the development hypothesis. Many replies to this work were given, the most celebrated being Hugh Miller's *Footprints of the Creator*; or, *the Asterolepis of Stromness*. The eminent metaphysician, Herbert Spencer, in an essay which appeared in the *Leader* in March, 1852, and republished in his *Essays* in 1858, contrasted the theories of special creation and development, and intimated his belief in the latter.

The last-named year began a new epoch in the history of the development hypothesis; 1 July 1858, a paper was read by Dr. Alfred Wallace, and another by Charles Darwin, on *'Natural Selection'*, a modification of the development hypothesis, to which each had come independently; the former on observation and reflection while studying the natural history of the Malay Archipelago, the latter by a powerful and long-continued consideration of the phenomena of organic life which he had witnessed during his voyage round the world in the Beagle surveying vessel from 1832 to 1836. This is the form in which the development hypothesis now flourishes. Darwin's celebrated book, *'The Origin of Species'*, first appeared in 1859, and his *'Descent of Man'* in 1871. Dr. Wallace's work on *'Natural Selection'* came out in 1870. One of the earliest converts to the new doctrines was Prof. Huxley, who has done an immense deal to defend them and render them popular. In Germany the same views are

earnestly advocated and carried out to an extreme length by Prof. Haeckel in his *'History of Creation'*, published in 1873, and of which an English translation appeared in 1875. What was formerly termed development, and sometimes more vaguely the transmutation of species, is now often called evolution. See *DARWINIAN THEORY*.

**Devens, Charles**, American jurist and general: b. Charlestown, Mass., 4 April 1820; d. Boston, Mass., 7 Jan. 1891. He was educated at Harvard, and was United States marshal for the district of Massachusetts at the time when the case of Thomas Sims, a fugitive slave, attracted widespread attention. Devens delivered Sims to his master in accordance with the law, and afterward tried to purchase his freedom, but did not succeed till after the outbreak of the Civil War. He served in the Union army from 1861 to 1865, retiring with the full rank of brigadier-general and the brevet rank of major-general. In 1873 he was made associate justice of the Massachusetts supreme court; in 1877 became attorney-general of the United States; and in 1881 resumed his place on the Supreme bench of his native State.

**Deventer**, dǎ'vën-tër, or **Demter**, Holland, an old town in the province of Overijssel, eight miles north from Zutphen, on the navigable river Yssel. It has a large town-hall, a court-house, and prison, places of worship for Calvinists, Lutherans, Mennonites, Roman Catholics, and Jews. The Groote Kerk has a fine Gothic tower and a crypt dating from the end of the 11th century. The followers of Gerard Groot, or "the Brethren of the Life in Common," have their college here. Deventer is famed for its "honey-cakes," a kind of gingerbread.

**De Vere, de vër**, **SIR AUBREY HUNT**, Irish poet: b. Curragh Chase, Ire., 28 Aug. 1788; d. there 5 July 1840. His works are: *'Julian the Apostate: a Dramatic Poem'* (1822); *'The Duke of Mercia: an Historical Drama'*, the volume containing also *'The Lamentations of Ireland'* (1823); *'The Song of Faith, Devout Exercises, and Sonnets'* (1842); and *'Mary Tudor: an Historical Drama'*, published posthumously (1847). His sonnets Wordsworth declared to be "the most perfect of our age."

**De Vere, Aubrey Thomas**, Irish poet and essayist: b. Curragh Chase, Ireland, 10 Jan. 1814; d. there 21 Jan. 1902. He was a son of Sir Aubrey De Vere (q.v.), and became a Roman Catholic in 1851. In 1842 his first volume of verse appeared, *'The Waldenses'*, and *'The Search after Proserpine'* (1843). His subsequent books of verse include: *'Poems, Miscellaneous and Sacred'* (1853); *'May Carols'* (1857); *'The Sisters'* (1861); *'The Infant Bridal'* (1864); *'Irish Odes'* (1869); *'The Legends of St. Patrick'* (1872); *'Alexander the Great'* (1874); *'Legends of the Saxon Saints'* (1879); *'The Foray of Queen Meave, and other Legends of Ireland's Heroic Age'* (1882); *'Legends and Records of the Church and the Empire'* (1887); and *'St. Peter's Chains'* (1888). Among his prose works are: *'English Misrule and Irish Misdeeds'* (1848); *'Picturesque Sketches of Greece and Turkey'* (1850); *'Ireland's Church Property and the Right Use of It'* (1867); *'The Church Establishment of Ireland'* (1867); *'Constitutional and Unconstitutional Political Ac-*

## DE VERE — DEVIL-WORSHIP

tion' (1881); 'Essays, Chiefly on Poetry' (1887); 'Essays, Chiefly Literary and Ethical' (1889); 'Recollections of Aubrey de Vere' (1897).

**De Vere, Maximilian Schele**, American philologist: b. near Wexiö, Sweden, 1 Nov. 1820; d. 1898. He came to the United States in 1843; and in 1844 became professor of modern languages and belles-lettres in the University of Virginia. His works include: 'Outlines of Comparative Philology' (1853); 'Stray Leaves from the Book of Nature' (1856); 'Studies in English'; 'Glimpses of Europe in 1848'; 'Romance of American History'; 'Wonders of the Deep'; etc.

**Dev'eron**, a river of Scotland, in Aberdeenshire and Banffshire, which flows into the sea at Banff. It is about 50 miles long. The salmon-fishery is very valuable.

**Devi**, *dā'vë*, in Hindu mythology, "the goddess," or Mahadevi "the great goddess," wife of the God Shiva and daughter of Himaviti (that is, the Himalaya Mountains). She is represented as a being of two characters, one gentle, the other fierce, and it is under the latter aspect that she is generally worshipped. In the Mahabharata she appears under many forms, and her individuality is fully developed in the Puranas.

**Devia'tion**, in the law of marine insurance, an unnecessary departure from the course of the voyage insured. The legitimate reasons for departure from the course are stress of weather, want of repairs, joining convoy, succoring ships in distress, danger from an enemy, sickness, and mutiny. Even in these cases the quickest courses must be taken. Deviation, from the moment at which it commences, discharges the underwriter from all liability.

**Deviation of the Compass**, the deviation of a ship's compass from the true magnetic meridian, caused by the proximity of iron. In wooden ships no magnetic deviation is perceptible so long as the ship is heading north or south. The greatest deviation is seen when the vessel heads east or west. In iron ships the magnetism is fixed by hammering and riveting, and the deviation manifests itself exactly in accordance with the point toward which the hull headed while these processes were going on. Armor-plated ships should be plated with their head in a different direction from that in which they lay when built. The mode now generally employed to correct deviation is by introducing on board ship masses of iron and magnets to exactly neutralize the action of the ship's magnetism. Compasses are sometimes carried on masts as a means of removing them from the disturbing influence of the iron of the hull. In this position they serve as standards of comparison for the binnacle compass. Wooden ships are also magnetized, so as to affect the compass, though in a far less degree, by the direction in which they lie when building.

**Devil** (O. E. *deofol*; O. S. *diubal*; O. H. G. *tiufal*; M. G. *Teufel*; Gothic, *diabolus*, from Gk. *διάβολος*, a slanderer), an evil spirit, Satan, the tempter, slanderer, and tormentor of human beings, according to the Scriptures of the Old and New Testaments. Most of the old religions of the East acknowledged a host of demons not good or bad, but merely exercising a salutary or injurious influence. In the latter case they

were looked upon as punishing spirits, without inimical or wicked purpose. Siva, the judging and destroying god of the Indian mythology, is a symbol of the great power of nature, which is alternately beneficent and injurious, but in itself neither good nor evil. Zoroaster named this evil principle *Ahriman*. The Greek mythology did not distinguish with the same precision between the good and bad spirits. Beelzebub, or Beelzeboul, appears to have been regarded by the Jews as the prince of the devils. According to the Mohammedans, who have derived their account from Jewish traditions, the devil, or, as they sometimes call him, *Eblis*, was an archangel, whom God employed to destroy the *jinnis* or genii, a race intermediate between men and angels, who tenanted the earth before the creation of Adam.

The Satan ("adversary") of the New Testament is a rebel against God. Endowed with the intellect and power of angels, he uses them since his fall to entangle men in sin, and obtain power over them.

The doctrine of Scripture on this subject soon became blended with numerous fictions of human imagination, with the various superstitions of different countries, and the mythology of the pagans. The gods of the ancients became evil spirits, seeking every opportunity to injure mankind. The excited imaginations of people frequently led them to suppose Satan visibly present; and innumerable stories were told of his appearance, and his attributes distinctly described. The writings of the fathers of the Church also contain several passages respecting the appearance of the devil. In many works or appearances of an extraordinary character, the devil was supposed to be concerned. Thus, many a dam, bridge, etc., has been built in one night with his assistance, and everyone knows that superstitious writers of former days, applying the legends that had become connected with Dr. Faust, the reputed worker of magic, to Fust, to whom the invention of printing has frequently been ascribed, taught that he invented the art by the help of Satan.

**Devil-fish**, huge rays of the family *Mantida*, which have a lozenge-shaped disk broader than long, with the head free from the pectoral fins and provided with a pair of anterior processes, and the tail long and whip-like. The two genera and six or seven species are confined to warm seas. So far as known, the young are produced alive after the eggs have hatched within the oviduct. The best known species are *M. birostris*, sometimes called the blanket-fish by tropical American pearl-fishers, from their belief that it attacks and devours men after enveloping them in its great wing-like pectoral fins, which reach a breadth of 20 feet. It is common in tropical American waters, and occurs on both the Atlantic and Pacific coasts of the United States. The name also applies to the *Octopus* and allied eight-armed *Cephalopoda* (qq.v.).

**Devil-worship**, the worship paid to the devil as a malignant deity, or the personified evil principle in nature, by many of the primitive tribes of Asia, Africa, and America, under the assumption that the powers of evil are as mighty as the powers of good, and have in consequence to be conciliated. There is a sect

## DEVIL'S ADVOCATE—DEVISE

called Devil-worshippers, or Yezidees, inhabiting Turkish and Russian Armenia and the valley of the Tigris, and numbering more than 200,000. They venerate the authority of the Old Testament above that of either the New Testament or the Koran. They practise both infant baptism and circumcision, and have a religious ministry of four orders. Their Christian ideas have reached them through Gnosticism. They pay respect to the devil, to Christ, and to Allah or the supreme being, and also worship the sun.

**Devil's Advocate.** See *ADVOCATUS DIABOLI*.

**Devil's Arrows,** three Druidical stone obelisks set up, probably as landmarks, near Boroughbridge, Yorkshire, England.

**Devil's Bible, The,** the popular name of a manuscript Bible written on ass-skin. The name arose from a legend that the writing was the work of a man who by the Devil's help accomplished it in a few hours in order to save his life, but who in return became the slave of the Evil One.

**Devil's-bit,** the common name of a species of scabious (*Scabiosa succisa*), of the natural order *Dipsacæ*. It has nearly globular heads of blue flowers, ovate leaves, and a fleshy root, which is, as it were, cut or bitten off abruptly. In America devil's-bit is one of the common names of *Lacinaria spicata*, which is known as dense button snakeroot, gay feather, backache-root, colic-root, etc. It belongs to the *Compositæ*, and is found in moist soil from Massachusetts to Florida and westward to Wisconsin and Louisiana.

**Devil's Bridge,** (1) an ancient bridge in Cardiganshire, Wales; it crosses the ravine through which flows the Mynach. (2) A bridge in Switzerland, crossing the Reuss, on the road over St. Gothard, from Germany to Italy.

**Devil's Coach-horse** (*Deypus oleus*), a common British and European beetle, belonging to the family *Staphylinidæ*. It has very much reduced wing-covers, and like many of its relatives has the habit of curving its body upward, to adjust the wings under their covers.

**Devil's Darning-needle.** See *DRAGON-FLY*.

**Devil's Dyke,** (1) an earthwork in Cambridgeshire, England, of prehistoric construction, about 20 feet in height. It is supposed to have been erected as a defense against enemies advancing from the Fen country. It extended from the fens, or marshes, to the wooded hills, and thus closed the only way of approach from the interior towns of England, and prevented raids upon whatever band of conquerors held the country near the sea. (2) A natural formation near Brighton, England. The old legend said this was the work of the "good spirits" who thus prevented the devil's attempt to flood the country because the people had abandoned paganism.

**Devil's-finger,** a name sometimes applied to the starfish (q.v.).

**Devil's Island** (*ISLE DU DIABLE*), a small rock formation off the coast of French Guiana, belonging to France. The area is about 16 square miles, and the island itself is sandy, dry, and torrid. Here Alfred Dreyfus was imprisoned for alleged treason.

**Devil's Parliament,** a nickname for an English parliament which met in 1459 at Cov-

entry. The parliament was under the control of Henry VI., and at his instigation proscribed and attainted for treason the Duke of York and his adherents.

**Devil's Punch-bowl,** a lake of Ireland, near the summit of Mangerton Mountain, in the vicinity of the Lakes of Killarney. It is between 2,000 and 3,000 feet above the level of the sea, and is supposed to be the crater of an ancient volcano. It is about half a mile in length and fully one third in breadth.

**Devil's Slide,** a gorge of the Utah Mountains, formed wholly by the natural arrangement of parallel crags and resembling an inclined plane. The accidental juxtaposition of two such boulder masses, accounted for by the simultaneous action of a cooling atmosphere on liquefied masses, is a feature of Utah scenery.

**Devil's Wall,** an ancient fortification in the southern part of Germany, about 368 miles long. This wall was originally a Roman ditch, with palisades behind it. It was intended to protect the Roman settlements on the left bank of the Danube, and on the right bank of the Rhine, against the inroads of the Teutonic and other tribes. Remains of it are found at present only from Abensberg, in Bavaria, to Cologne. As to the time when this rampart was built our information is very scanty. Some parts of the northern Roman fortifications may be as old as the time of Drusus. The Decumat or Tithe Lands, however; that is, the lands to the east of the Rhine and north of the Danube, which the Roman emperors allowed immigrants to settle on, on condition of paying tithes to the state, do not appear to have had any protecting wall about 14 B.C. The main rampart, stretching southward from the Main to the Danube, was probably completed under Hadrian, and parts of it which had been destroyed seem to have been restored by Probus. All the parts of this great rampart are still far from being thoroughly investigated.

**De Vinne, Theodore Low,** American printer: b. Stamford, Conn., 25 Dec. 1828. He learned the printer's trade and became an employee and later partner of Francis Hart, upon whose death he founded the firm of Theodore L. De Vinne and Company in New York. He has written several works on typography, including 'Invention of Printing,' and 'Historic Types.'

**Devise,** *de-vîz'*, a gift of real property by a person's last will and testament. The term devise technically and properly only applies to real estate; the object of the devise must therefore be that kind of property. The word, however, is sometimes improperly applied to a bequest or legacy. In regard to a lapsed devise, where the devisee dies during the life of the testator, although there may be a residuary devisee, the estate will go to the heir. But if the devise be void, as where the devisee is dead at the date of the will, or is made upon a condition precedent, which never happens, the estate will go to the residuary devisee, if the language is sufficiently comprehensive (4 Kent Com., 541, 542, and cases cited in notes). But some of the cases hold in that case, even, the estate goes to the heir (4 Ired. Eq., N. C., 320; 6 Conn., 292). In England a residuary bequest operates upon all the personal estate which the testator is possessed of at the time of his death, and will include such as would have gone to pay specific legacies which lapse or are void. A general de-

## DEVIZES — DEVONIAN SYSTEM

vise of lands will pass a reversion in fee, even though the testator had other lands which will satisfy the words of the devise, and although it be very improbable that he had such reversion in mind. A general devise will pass leases for years, if the testator have no other real estate upon which the will may operate; but if he have both lands in fee and lands for years, a devise of all his lands and tenements will commonly pass only the lands in fee simple. But if a contrary intention appear from the will, it will prevail. A devise in a will can never be regarded as the execution of a power, unless that intention is clear, as where otherwise the will would have nothing on which it could operate. But to have that operation the devise need not necessarily refer to the power in express terms. But where there is an interest on which it can operate, it shall be referred to that, unless some other intention is obvious. The devise of all one's lands will not generally carry the interest of a mortgagee in premises, unless that intent is apparent. Devises are contingent or vested—that is, after the death of the testator; contingent when the vesting of any estate in the devisee is made to depend upon some future event, in which case if the event never occur, or until it does occur, no estate vests under the devise. But when the future event is referred to merely to determine the time at which the devisee shall come into the use of the estate, this does not hinder the vesting of the estate at the death of the testator.

**Devizes**, de-vi'zēz, England, a municipal borough in the county of Wilts, 82 miles southwest of London. The chief manufactures are steam-engines, boilers, gas-engines, and beer. Pop. 6,914.

**Dev'on**, a river of Scotland, which has its source at the foot of the Ochill Hills, and flows into the Forth about two miles above Alloa. Its length is 34 miles. Below the Crook of Devon are a series of cascades, the most noted of which are the Caldron Linn and those at the Rumbling Bridge.

**Devo'nian Period.** In Devonian time, that part of Paleozoic time, following Silurian and preceding Carboniferous, North America was represented by a northern continental land mass and by an Appalachian land mass on the east, this Appalachian land having its western boundary where are the Blue Ridge Mountains, and extending as far south as Georgia; its eastern boundary, probably now covered by the Atlantic Ocean, may have been many miles from the present shore line. A continental land mass extended from the Hudson River westward, its shore line forming a great bay that covered central New York and part of Ontario, Ohio, and Michigan, and extending westward across Illinois, possibly connected with an uplift that reached from Wisconsin to South America. West of Wisconsin the Devonian land may have reached Montana. From northern Minnesota the continental shore line extended northwest to the Arctic Ocean in the neighborhood of the mouth of the Mackenzie River. The Gulf of St. Lawrence was much larger than now, and several long, narrow channels or sounds extended from it southwestward across New England and New Brunswick. There were islands along the line of the Cincinnati anticline in Ohio, Kentucky and Tennessee. There was a land area in

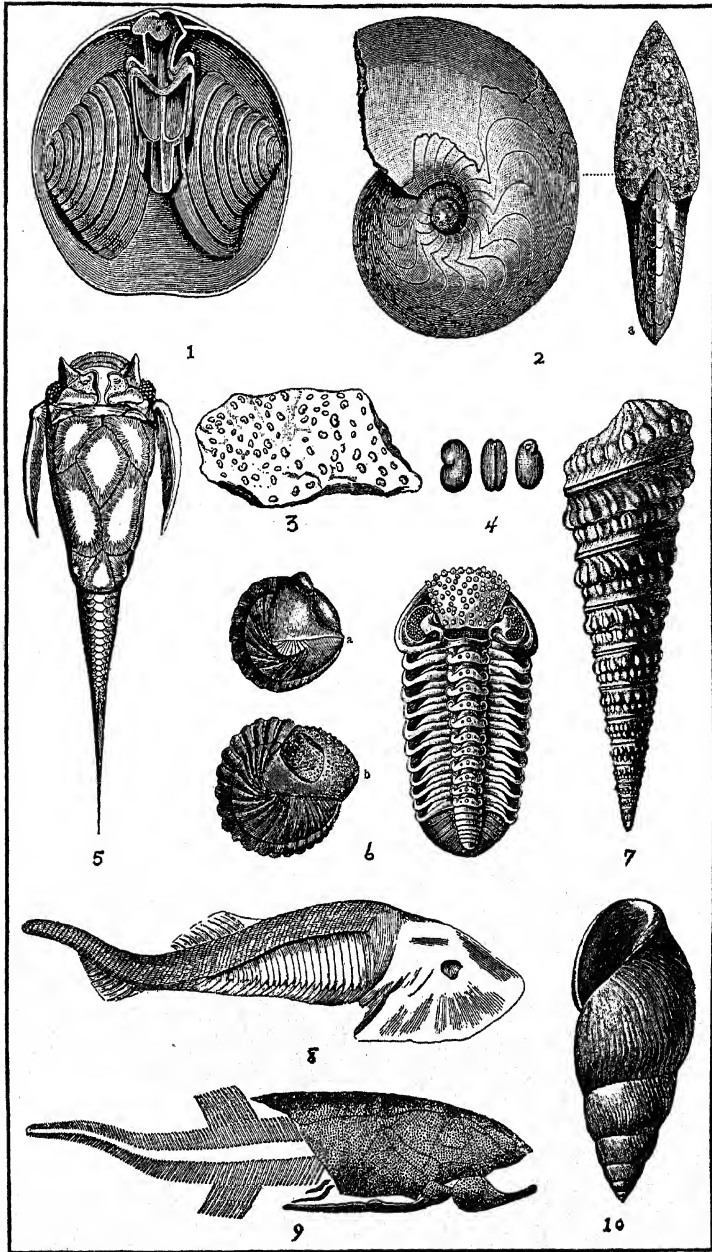
eastern Colorado, another covering the area of the Black Hills in South Dakota, another in central Texas and there was a long narrow strip of land along the west side of what is now the great basin in Nevada and Utah.

In middle Devonian time Europe was largely covered by an open sea containing numerous islands, and most of Russia and Siberia and part of Central Asia were under water. In Scotland and Wales were landlocked seas or lakes, and there were others in western Russia. A large part of central South America was covered by water. Fossil evidence indicates that in early Devonian there were land connections between North and South America, and between South America and South Africa. The vegetable and animal life of Devonian time, so far as can be determined, did not differ greatly from Silurian forms, though it shows a general advance toward more highly developed types. The land vegetation included cryptogams and Gymnosperms. Of the cryptogams the tree-ferns and the giant club-mosses (*Lepidodendra*) must have been conspicuous in the forests, being over 50 feet high. Of the gymnosperms, cycads, now almost extinct, were abundant, and it is possible that conifers of the yew family grew upon the higher ground.

Of animal life the trilobites, so abundant in Cambrian and Silurian time, were less important, but other crustaceans developed greatly, including the eurypterids, related to the horseshoe crabs, and decapods, or lobsters. Corals were very abundant in the Devonian oceans. Crinoids, or sea-lilies, and starfish were more abundant than in Silurian time. The brachiopods, or lamp-shells, apparently were, as in Silurian, the most abundant elements of marine life. Of mollusks, there were bivalves and gastropods; the ammonites appeared among the cephalopods, and nautilus-like forms were less abundant than in the Silurian. The chief characteristic of Devonian time, however, was the great development of the fishes, the Devonian being known as the "age of fishes." Many of the Devonian forms, however, have long been extinct, while the teleosts, which include by far the greater part of modern fishes, evidently did not exist at all in Devonian time. Among the odd Devonian forms were the ostracodermata, fish-like animals allied to the lampreys, but having the head and sometimes a large part of the body covered with bony plates. Of the true fishes the selachians, or sharks, were represented, as were the dipnoi or lung fishes, now almost extinct. The most highly developed Devonian fishes were the ganoids, now represented by the sturgeon and the gar-pike. See DEVONIAN SYSTEM; PALEOZOIC ERA.

**Devonian System.** The name Devonian appeared in geological literature in 1839, when Murchison and Sedgwick applied it to a rock system in Devonshire and Cornwall, England, consisting of conglomerates, shales and fossiliferous limestones lying below the carboniferous rocks and above the great mass of the graywacke or transitional series of Werner that was already included in the Cambrian or Silurian. Murchison and Sedgwick also included in the Devonian the old red sandstone of Scotland. In the United States, Hall of the New York Geological Survey, in an admirable report published in 1843, divided the Cambrian, Silurian,

# DEVONIAN FOSSILS.



1. A Brachiopod (*Athyris concentrica*); interior of dorsal valve, showing spiralia.
2. An Ammonite (*Goniatites intumescens*); a lateral view.
3. Hulls of fossil Entomostracans (*Cyprididae*) in a slab of schist.
4. Shells of the same (*Cypridina serratostrata*).
5. An Armored Fish (*Pterichthys cornuta*).
6. A Trilobite (*Phacops latifrons*), shown in a and b rolled up.

7. A Gasteropod Mollusc (*Murchisonia bigranulosa*).
8. A Great Armored Fish (*Cephalaspis lyelli*); restored.
9. The Berry-bone Fish (*Coccoosteus decipiens*); restored.
10. A Gasteropod Mollusc (*Macrocheilus subcostatus*).





## DEVONPORT — DEVRIENT

and Devonian systems of the Appalachian formations, and his work has needed little revision. The rocks of the Devonian System in North America are now subdivided into the Lower or Oriskany and Corniferous series, the Middle or Hamilton, and the Upper or Chemung. The Corniferous is subdivided into the Schoharie and Corniferous stages, the Hamilton into the Marcellus and Hamilton stages, and the Chemung into the Portage and Chemung stages. Where the line between the Silurian and Devonian systems should be drawn in North America is still a matter of dispute, the lower Helderberg formation of the Silurian being assigned to the Devonian by some European geologists. Of the stages named above, the Oriskany is a calcareous sandstone, covering eastern New York and extending south into Virginia, while on the west it extends into Ontario. It also outcrops in Illinois and in northern Alabama. It forms thick strata in Maine, and occurs in eastern Quebec. The Schoharie stage includes grits and fine conglomerates and having about the same distribution as the Oriskany. The Corniferous is a great limestone formation, largely made of corals, found in New York, Pennsylvania, Virginia, Ohio, Indiana, Illinois, Missouri and Iowa, also in Vermont and Quebec. The Hamilton series, which has about the same distribution as the Corniferous, is represented by a great thickness of shales and shaly sandstones in New York and Ohio. It thins out southward and westward, and in Indiana, Illinois, Missouri and Iowa is represented by limestones. It is represented by sandstones and shales in eastern Quebec, and in New Brunswick and Nova Scotia. The Chemung series includes a thick shale and sandstone formation in New York, Ohio and Pennsylvania, but thins away rapidly to the westward. The flags, grits, shales, and sandstone of the Catskill group in New York are included for the most part in the Chemung. In Manitoba and the Northwest Territory, Canada, the Devonian System includes limestones and shales, and is of moderate thickness. There is an area of Devonian rocks extending along the Rocky Mountains from Montana across Alberta. In the United States the Devonian rocks of the Rocky Mountains appear in Colorado and Arizona. There are also ores in the Wasatch Mountains in Utah, in Nevada and in California.

In England and on the continent the Devonian System presents two different classes of rocks, (1) the Old Red Sandstone, occurring in Scotland, in South Wales and across the Welsh border in England, also in the Baltic provinces of Russia, and in Spitzbergen; and (2) the Marine Devonian, occurring in southwest England, in northern and southern France, in Spain, and over large areas in Germany and central Russia. The Old Red Sandstone was laid down in shallow seas either closed or having only slight connection with the open ocean. The formation is of interest from its containing remains of Devonian land animals and plants. The rocks are fine-grained conglomerates, sandstones, and shales. The Marine Devonian of Europe is largely limestone with some shales and slates.

Devonian rocks in Asia are found over a vast area in Siberia and also occur in China and in Asia Minor. In Africa they are found both in the northern and southern parts of the continent. In South America Devonian rocks form

a great system, being found in Brazil, Bolivia, and the Falkland Islands. See CATSKILL GROUP; CHEMUNG STAGE; CORNIFEROUS STAGE; HAMILTON STAGE; MARCELLUS STAGE; PORTAGE STAGE; OLD RED SANDSTONE; ORISKANY STAGE.

See Zittel, 'History of Geology and Palæontology'; Dana, 'Manual of Geology'; Geikie, 'Text-book of Geology'; Leconte, 'Elements of Geology.'

**Dev'onport** (before 1824 called **Plymouth Dock**), England, a parliamentary and municipal borough, maritime town, and naval arsenal, in the southwest of Devonshire. It owes its existence to the dockyard established here by William III. in 1689, and is one of the chief naval arsenals in Great Britain.

**Dev'ons**, the name given to a breed of cattle which were first bred in Devonshire, England. They are rather wild, of a dark-red color, and can be used instead of horses for plowing. They are smaller than Shorthorns or Herefords. The bull has a small head, fine muzzle and face, very handsome horns, which should taper upward and rather backward; the eye is large and rather wild, indicating an active disposition; the neck is arched, but the dewlap is not much developed; tail set on rather high; good barrel well up behind the shoulder; not the depth of carcass in the same height as is found in the Shorthorns; skin of a dark-red and rather mottled character, and plenty of long curling hair; the skin is thicker than that of Shorthorns, but not so thick as that of Herefords. They form a good deal of inside fat and firm meat. The cows yield a very rich milk. They are hardy, and able to find food on poor uplands.

**Dev'onshire**, **Spencer Compton Cavendish**, 8TH DUKE OF, English statesman: b. 23 July 1833. He succeeded to the ducal title in 1891, having previously become well known by his courtesy title of the Marquis of Hartington. First returned to the House of Commons in 1857, he was appointed a lord of the admiralty in 1863, and secretary of state for war in 1866. He was postmaster-general under Gladstone 1868-71, and chief secretary for Ireland 1871-4. He was secretary for India 1880-82, and became secretary of state for war 1882-5. Since 1886 he has been recognized as an active and influential leader of the Liberal Unionists, and on the formation of a Unionist ministry in 1895 accepted the post as lord president of the council.

**Devonshire**, the third largest county in England, situated in the southwest. It is famous for its Old Red Sandstone (see DEVONIAN SYSTEM). This county contains the barren tract of Dartmoor and also the valley of the Exe, called "The Garden of Devonshire." For history, see ENGLAND.

**Devrient**, dĕv-rĕ-ăn, a family of German actors, of whom the most talented was LUDWIG DEVRIENT (1784-1832), distinguished both in comedy and in tragedy, and especially noteworthy as an exponent of Shakespearian characters. His nephew, CARL AUGUST (1797-1872), the eldest of the brothers Devrient, played lovers' parts and was the husband of the *diva*, Madame Schröder-Devrient (1805-60). PHILIPP EDUARD (1801-77), the second brother, was a delightful baritone singer in the early part of

the 19th century, and afterward became a painstaking, though not a great actor. He was the author of a number of plays, and of the valuable 'Geschichte der deutschen Schauspielkunst' (1848-74); and with his son Otto (1838-94) prepared an edition of Shakespeare. GUSTAV EMIL (1803-72), the youngest and most gifted of the three brothers, was most successful in tragic and emotional parts, and became identified in Germany with such characters as Hamlet, Tasso, and especially Posa.

**De Vries, de vrēs, David Peterzen**, Dutch colonist in America. Nothing definite is known as to the dates of his birth and death. He was a member of a company organized in 1630 to settle the tract of land in the present State of Delaware, which had been bought in 1629 from the Dutch West India Company by Samuel Blommaert and Samuel Godyn. On his arrival 1632 he found that the colony founded 1631 on Lewes Creek, Cape Henlopen, and called with the surrounding country "Swaanendael," had been completely destroyed by the Indians. He left some of his party there and visited Virginia, but took the colonists back to Holland in 1634. Later he visited Manhattan several times and tried to found a colony on Staten Island, which the Indians destroyed in 1640. He also lived on a plantation called Vriessendael, on the site of Tappan, N. Y. Among his works is: 'Korte historiaal ende Journaels Aenteyckeninge van verscheyden Voyagien in der Vier Teelen des Wereldts Ronde'; 'A short history and notes of a journal kept during several voyages in the four parts of the world' (1655).

**Dew, Thomas Roderic**, American publicist: b. King and Queen County, Va., 5 Dec. 1802; d. Paris, France, 6 Aug. 1846. He was graduated from William and Mary College, and in 1827 was elected professor of political economy, history, and metaphysics in William and Mary College, and in 1836 was made president of that institution. In 1829 he published his 'Lectures on the Restrictive System.' It was brought out at a moment when feeling ran high on the subject of the tariff, between protectionists and free-traders; and though emanating from the closet of a thinker removed from the agitations of political warfare, took a strong hold on the public mind, and the subsequent adoption of the compromise of 1832 may be attributed in part to its silent influence. His most elaborate work was 'A Digest of the Laws, Customs, Manners, and Institutions of the Ancient and Modern Nations' (1853).

**Dew**, a deposition of water from the atmosphere upon the surface of the earth. During the day the earth both absorbs and emits heat, but after sunset its supply of warmth is cut off, while it still continues to radiate heat into the surrounding space. Grass, flowers, and foliage being good radiators, lose after sunset the heat which has previously been absorbed by them, without receiving any in return, and their temperature consequently falls considerably below that of the atmosphere. From the proximity of these cold substances the particles of vapor in the adjoining air are condensed and deposited upon their surfaces in the form of dew, or of hoarfrost where the temperature of the earth is below 32°. When the sky is clouded the heat abstracted from the earth's surface by radiation is restored by the clouds,

which, being good radiators, transmit an equal amount of heat to what they receive; and a balance of temperature being thus maintained between the earth and the surrounding atmosphere, no dew is formed. The deposition of dew is likewise prevented by wind, which carries away the particles of air before the vapor contained in them has been condensed by the heat imparted by the adjoining radiating substances. Horizontal surfaces, and those which are exposed to a wide expanse of sky, receive a greater supply of dew than sheltered or oblique surfaces, where circumstances diminish the amount of radiation.

An acquaintance with the cause which produces dew and hoarfrost enables us to understand the rationale of the process resorted to by gardeners to protect tender plants from cold, which consists simply in spreading over them a thin mat or some flimsy substance. In this way the radiation of their heat to the heavens is prevented, or rather the heat which they emit is returned to them from the awning above, and they are preserved at a temperature considerably higher than that of the surrounding atmosphere. To insure the full advantage of this kind of protection from the chill of the air, the coverings should not touch the bodies they are intended to defend.

The radiation from the earth's surface is one of those happy provisions for the necessities of living beings with which nature everywhere abounds. The heavy dews which fall in tropical regions are in the highest degree beneficial to vegetation, which, but for this supply of moisture, would, in countries where scarcely any rain falls for months, be soon scorched and withered. But after the high temperature of the day the ground radiates under these clear skies with great rapidity, the surface is quickly cooled, and the watery vapor, which, from the great daily evaporation, exists in large quantities in the atmosphere, is deposited abundantly. This deposition is more plentiful also on plants, from their greater radiating power; while on hard, bare ground and stones, where it is less wanted, it is comparatively trifling. In cold climates the earth, being cold and sufficiently moist, requires little dew; accordingly the clouds, which are so common in damp and chilly regions, prevent the radiation of heat: the surface is thus preserved warm, and the deposition of dew is, in a great measure, prevented.

**Dewas, dā-wās'**, India, (1) a native state in the Nimar and Malwa agency, consisting of two combined states with two chiefs; area 883 square miles. Grain, opium, sugarcane, and cotton are its chief productions. Pop. 152,073. (2) Dewas, the chief town, contains the residences of both chiefs, and near it, on a conical hill, is a temple. Pop. 15,100.

**Dewberry, *Rubus villosus***, or *Rubus canadensis*, a trailing plant of the natural order *Rosaceæ*. Its prickly stems, leaves, and fruit resemble the blackberry. During the last quarter of the 19th century it became popular as a cultivated fruit, principally through the introduction of its variety, the *Lucretia*, which is superior to the wild forms common as weeds on wornout pastures and poor land. The plants, which are propagated by means of stem-tips, do best on a rather lighter soil than the black-

berry, like which, with the exception of training, it is cultivated and fertilized. They are usually trained to stakes or trellises, and not given summer pruning, except in the removal of canes as soon as they have fruited. The usual distances for planting are three or four feet by six. The fruits ripen considerably in advance of the blackberries. See BLACKBERRY; RASPBERRY; RUBUS.

**Dewdney, Edgar**, Canadian statesman: b. Devonshire, England, 1835. He studied civil engineering, and on removing to Canada was employed to lay out the town of New Westminster. Though working at his profession for a number of years, he took an active interest in politics, was elected to the legislature of British Columbia in 1869, and in 1872 was elected to the Canadian Parliament, where he was one of the chief supporters of Sir John Macdonald of the Opposition. In 1871 he was appointed Indian Commissioner for the Northwest Territory, and in 1881 lieutenant-governor of the Territory, holding the two offices until 1888, when he became minister of the interior in the Canadian cabinet. In 1892 he was appointed lieutenant-governor of British Columbia.

**Deweese', William Potts**, American physician: b. Pottsgrove, Pa., 5 May 1768; d. Philadelphia 18 May 1841. He attended several courses of medical lectures at the University of Pennsylvania, and in 1793 began practice in Philadelphia. Here he achieved for himself a high reputation, especially in that department to which he devoted particular attention, midwifery, previously much neglected in America. He published 'Inaugural Essays'; 'System of Midwifery,' of which latter many editions have been printed'; 'A Treatise on the Physical and Medical Treatment of Children'; 'A Treatise on Diseases of Females'; 'Practice of Medicine' (1830). In 1826 he was elected adjunct professor, and in 1834 professor of obstetrics and diseases of women and children in the University of Pennsylvania.

**De Wet, dā-vět', Christian**, Boer general: b. Dewetsdorp, Orange Free State (now Orange River State), about 1860. He was bred a farmer, made a small fortune, and became a member of the Volksraad. Though practically without military experience, he served ably in the Boer-British War of 1899-1900, attaining the rank of general and outwitting the pursuit of Kitchener and Roberts in the summer of 1900, and of the former in the early part of 1901. His stand at Sanna's Post was highly praised by military experts. He was especially noted for his humane treatment of prisoners of war. His 'Three Years of War' was published in 1902.

**De Wette, dē vët'tě, Wilhelm Martin Leberecht**, German theologian: b. Ulla, near Weimar, January 1780; d. Basel, Switzerland, 16 June 1849. In 1807 he became professor of theology at Heidelberg, and in 1810 he was called to be the colleague of Schleiermacher at Berlin. In 1822 he accepted the chair of theology at Basel, where he remained till his death. The influence of De Wette's views upon the theological tendencies of his time was most important. He was remarkable for his critical acuteness, and for his powers of concise and clear exposition. His works are very numerous. Among

them are: 'Beiträge zur Einleitung in das Alte Testament' (1806-7); 'Lehrbuch der historisch-kritischen Einleitung in die kanonischen und apokryphischen Bücher des Alten Testaments' (1817); 'Einleitung in das Neue Testament' (1826); 'Lehrbuch der hebräisch-jüdischen Archäologie' (1814); 'Kurzgefasstes exegetisches Handbuch zum Neuen Testament' (1836-48). These works are all more or less of a critical nature; in the following he developed his own theological views: 'Lehrbuch der christlichen Dogmatik' (1813-16); 'Christliche Sittenlehre' (1819); and the didactic novel, 'Theodor oder des Zweiflers Weihe' ('Theodore, or the Consecration of the Sceptic,' 1822).

**Dewey, Chester**, American educator: b. Sheffield, Mass., 25 Oct. 1784; d. Rochester, N. Y., 15 Dec. 1867. He was graduated at Williams College in 1806, where, in 1810, he became professor of mathematics and natural philosophy, a post he held 17 years. In 1836 he was appointed principal of the Collegiate Institute in Rochester, N. Y., and in 1850 became professor of chemistry and natural philosophy in the University of Rochester, resigning 10 years later. He was an authority on grasses. He wrote 'History of the Herbaceous Plants of Massachusetts,' and valuable papers on botany.

**Dewey, Davis Richard**, American political economist and statistician: b. Burlington, Vt., 7 April 1858. He is a brother of John Dewey (q.v.). He was educated at the University of Vermont, and at Johns Hopkins University. He is professor of economics and statistics in the Massachusetts Institute of Technology, and secretary of the American Statistical Association. His works are: 'Syllabus of Political History Since 1815'; 'Report of Massachusetts Board to Investigate the Subject of the Unemployed' (1895); 'Report of Commission to Investigate the Public Charitable and Reformatory Interests and Institutions of the Commonwealth' (1897); 'Financial History of the United States' (1902).

**Dewey, George**, American naval officer: b. Montpelier, Vt., 26 Dec. 1837. At 17, after a preparatory course in the Northfield Military School, young Dewey was appointed a cadet at Annapolis, in the class which was graduated in 1858. At the outbreak of the Civil War he was commissioned a lieutenant under Admiral Farragut and assigned to the sloop-of-war Mississippi. His first active experience in war was when the West Gulf squadron, early in 1862, forced a passage up the Mississippi River ahead of Farragut. A later enterprise resulted in the grounding of the Mississippi, in the middle of the night, while attempting to run the batteries of Port Hudson. Here she was riddled with shot and set afire by the enemy's batteries, so that officers and crew had to abandon her, and make their way as best they could to the other shore before the flames reached her magazine and she exploded.

Other notable engagements in which Dewey figured during the Civil War were at Donaldsonville in 1863, and at Fort Fisher in the winter of 1864-5, as an officer of the Agawam. Receiving his commission as lieutenant-commander in March 1865, he served for two years on the Kearsarge and the Colorado, and was then attached to the Naval Academy for two years more. In 1870 he was given command of the Narragansett, and during his five years' charge

of her rose to be a commander. He was then attached to the Lighthouse Board, and in 1882 took his next sea duty in command of the *Juniata* of the Asiatic squadron. On reaching his captaincy, in 1884, he took charge of the *Dolphin*, one of the first vessels of the new navy. From 1885 to 1888 he commanded the *Pensacola*, then flagship of the European squadron; and this service was followed by shore duty, in the course of which he served as chief of the Bureau of Equipment at the Navy Department, and afterward on the Lighthouse Board for a second time. In 1896 he was promoted to commodore, and made president of the Board of Inspection and Survey. At the beginning of 1898, a few weeks before the outbreak of the Spanish-American war, he was placed in command of the Asiatic squadron, and was thus given the chance to distinguish himself which he so brilliantly improved.

With his squadron he left Miao Bay, China, 27 April 1898, with orders to "capture or destroy the Spanish squadron," then supposed to be in Manila Bay, under command of Admiral Montejó. The squadron entered the channel of Manila at 11:30 P.M., Saturday, 30 April, and early on Sunday morning, 1 May, sank, burned or captured all the ships of the Spanish squadron in the bay, silenced and destroyed three land batteries, obtained complete control of the bay, so that he could take the city, the chief port of the Philippine Islands, at any time, and all without losing a single man, and having only nine slightly wounded. On 18 August Dewey and his ships aided Gen. Merritt in the capture of Manila. In recognition of his Manila Bay achievement, Commodore Dewey received the thanks of Congress, which awarded to him a magnificent sword, and medals to his men. As a further recognition of his achievement, Commodore Dewey was (7 May 1898) promoted to be a rear-admiral, and subsequently (3 March 1899) made admiral of the navy under an act of Congress, approved 2 March 1899, restoring that rank for the especial purpose of enabling the country to honor adequately the hero of Manila Bay. In 1901 he was president of the Schley court of inquiry, and in 1902 was appointed commander-in-chief of the united squadrons and fleets mobilized for extraordinary manoeuvres. Consult Clemen's 'Life of Dewey' (1899).

**Dewey, John**, American psychologist: b. Burlington, Vt., 20 Oct. 1859. He was educated at the University of Vermont and has been professor of philosophy at the University of Chicago from 1884, and editor of the 'Elementary School Record.' Among his works are: 'Psychology'; 'Leibnitz's New Essays Concerning Human Understanding'; 'Critical Theory of Ethics' (1891); 'Study of Ethics.'

**Dewey, Melvil**, American educator and librarian: b. Adams Centre, N. Y., 10 Dec. 1851. He was graduated from Amherst College in 1874; was college librarian during his senior year and for two years after graduation. He then went to Boston where he was active in founding the American Library Association, the Library Bureaus, the Metric Bureau for introducing the metric system, and the Spelling Reform Association. He was the founder and for five years the editor of the 'Library Journal' and also editor of 'Library Notes' and the

'Spelling Reform Bulletin.' In 1883 he was appointed librarian at Columbia, and in 1887 established the school of library economy, of which he was made director. In 1889 he became secretary of the University of the State of New York, and director of the State library, the library school being at that time transferred to Albany; in 1891 he became director of the home education department, and organized the system of traveling libraries. In New York State he has accomplished much in the raising of school standards, and particularly in the improvement and founding of small public libraries. He has also had much influence on library work in the United States; has twice been president of the American Library Association, and its secretary for 15 years; he devised the decimal system for the classification of books which is widely used, and published a set of cataloguing rules, included in his 'Library School Rules.' He has also published a revision of the laws of New York State in regard to education (1892), and the 'Decimal Classification and Relative Index' (1885).

**Dewey, Orville, D.D.**, American Unitarian clergyman: b. Sheffield, Mass., 28 March 1794; d. there 21 March 1882. He was graduated at Williams College in 1814, and pursued his divinity studies at Andover Theological Seminary 1816-19; but became a Unitarian and soon after an assistant of Dr. Channing. He was pastor of the Unitarian Church in New Bedford 1823-33, and of the 2nd Unitarian Church in New York 1835-48. He published: 'The Old World and the New' (1836); 'Letters on Revivals'; 'Discourses on Human Nature'; 'Discourses on Human Life'; 'Discourses on the Nature of Religion'; 'Discourses on Commerce and Business'; 'Miscellaneous and Occasional Discourses'; 'The Unitarian Belief'; 'Discourses and Reviews.'

**De Windt, de wint, Harry**, English explorer: b. Paris, France, April 1856. He was educated at Cambridge, and after serving as aide-de-camp to his brother-in-law, Rajah Brooke of Sarawak, 1876-8; went from Peking to Paris by land 1887; visited mines and prisons in Siberia 1890-4; explored the Klondike 1897, and went from Paris to New York by land for the London *Daily Express* 1901-2. He has written: 'On the Equator' (1882); 'From Peking to Calais by Land' (1887); 'A Ride to India' (1890); 'Ennui de Voyage,' poems (1890); 'Siberia as it Is' (1892); 'The New Siberia' (1895); 'A Queer Honeymoon,' a novel; 'Through the Gold Fields of Alaska to Bering Strait' (1898); 'True Tales of Travel and Adventure' (1899); 'Finland as it Is' (1901).

**Dewing, Thomas Wilmer**, American figure and portrait painter: b. Boston 4 May 1851. He was a pupil of Boulanger and Lefebvre and is an academicien of the National Academy of Design 1888, and a member of the Society of American Artists. Among his pictures are: 'Prelude'; 'The Days,' which took the Clarke prize in 1887, and 'The Garden.'

**De Wint, Peter**, English landscape painter in water-colors: b. Stone, in Staffordshire 21 Jan. 1784; d. London 30 June 1849. He studied in the schools of the Royal Academy, where he occasionally exhibited; but most of his pictures were shown in the exhibitions of the Water-color Society. English scenery was his



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ADMIRAL GEORGE DEWEY.





favorite subject. He occasionally painted in oil with marked success. Some of his best pictures are: 'A Corn-field'; 'Woody Landscape with Water'; 'Lincoln Cathedral'; and 'Harvest-time.'

**De Witt, Jan**, yān dē wīt, Dutch statesman: b. Dort 1625 or 1632; d. The Hague 20 Aug. 1672. He became the leader of the political party opposed to the Prince of Orange, and in 1652, two years after the death of William II., was made grand pensionary. In 1665 the war with England was renewed and conducted by De Witt with great ability till its termination in 1665. In 1672 Louis XIV. invaded the Spanish Netherlands and involved Holland in war. De Witt's popularity, already on the decline, suffered still further in the troubles thus occasioned, and he felt it necessary to resign his office of grand pensionary. At this time his brother Cornelius, who had been tried and put to torture for conspiring against the life of the young Prince of Orange, lay in prison. Jan de Witt went to visit him, when a tumult suddenly arose among the people, and both brothers were murdered. De Witt was a man of high character, simple and modest in all his relations.

**Dewitt, John**, American Dutch Reformed clergyman: b. Albany, N. Y., 29 Nov. 1821. He was graduated at Rutgers College in 1838, and at New Brunswick, N. J., Theological Seminary in 1842. He was pastor of several churches 1842-63, and professor of Oriental literature and of Hellenistic Greek at the New Brunswick Theological Seminary 1884-91. He has been a member of the American Testament Revision Committee since 1872. Among his works are: 'The Sure Foundation'; 'Praise Songs of Israel'; 'The Psalms,' a new translation; and 'What is Inspiration?'

**Dewitt, John**, American Presbyterian theologian: b. Harrisburg, Pa., 10 Oct. 1842. He graduated at Princeton 1861; took up the study of theology at Princeton Theological Seminary and at Union Theological Seminary, New York, and was ordained to the ministry in 1865. He has been pastor of several churches, professor of ecclesiastical history Lane Seminary, Cincinnati, 1882-8, and professor in McCormick Theological Seminary, Chicago, 1888-92. He has published 'Sermons on the Christian Life.'

**De Worms, Henry**, 1ST BARON PIRBRIGHT, English statesman and writer: b. 1840; d. London 10 Jan. 1903. He was educated at King's College, London, was admitted a barrister of the Inner Temple in 1863, and sat in the House of Commons for Greenwich 1880-5, and for Toxteth 1885-95. He was under-secretary of the colonies 1888-92. He published 'England's Policy in the East'; 'The Earth and its Mechanism'; 'The Austro-Hungarian Empire'; 'Memoirs of Count Beust.'

**Dewsbury**, England, a municipal and parliamentary borough in the West Riding of Yorkshire; 30 miles southwest of the town of York; on the Calder. Coal is mined, but the trade of the town is chiefly in heavy woolen cloths, including blankets, carpets, flannels, and worsteds. It has manufactories for fancy cloths and shoddy goods, contains iron and boiler works. Pop. of municipal borough 29,637; of parliamentary borough 74,349.

**Dexter, Henry**, American merchant: b. West Cambridge (now Arlington), Mass., 14 Vol. 6—17

March 1813. He early established a connection with publishing firms in Boston and Cambridge, which was continued until 1836. He then went into the hardware business, remaining in this until 1842, when he took up the wholesale trade in books, periodicals and newspapers. He organized the American News Company in 1864, serving as president.

**Dexter, Henry Martyn**, American Congregational clergyman: b. Plympton, Mass., 13 Nov. 1821; d. New Bedford, Mass., 13 Nov. 1890. He was graduated at Yale 1840, and at Andover Theological Seminary 1844. He filled a pulpit in Manchester, N. H., 1844-9, and was pastor of Berkeley Street Church, Boston, 1849-67. He was one of the editors of the 'Congregational Quarterly' from 1859 to 1865, becoming editor-in-chief of the 'Congregationalist' 1867. He was a staunch defender of the Congregational polity and delighted in controversy. His principal works are: 'The Voice of the Bible and the Verdict of Reason' (1858); 'Congregationalism: What it Is, Whence it Is, How it Works. Why it is Better than Any Other Form of Church Government, and its Consequent Demands' (1865); 'Roger Williams and His Banishment From the Massachusetts Colony' (1876); 'The Congregationalism of the Last Three Hundred Years' (1881); 'Common Sense as to Woman Suffrage' (1885); 'Early English Exiles in Amsterdam' (1890).

**Dexter, Samuel**, American statesman and jurist: b. Boston 14 May 1761; d. Athens, N. Y., 4 May 1816. He was graduated at Harvard University 1781; was admitted to the bar in 1784. He was repeatedly chosen to the legislature of Massachusetts, and in 1798 was elected senator of the United States. While senator he was appointed secretary of war in 1800, and in the same year secretary of the treasury. He was afterward, at different times, offered foreign missions, but always refused them. About the year 1802 he withdrew from political life, and returned to his profession. He was an unsuccessful candidate for governor in 1814. He was the first president of the first society formed in Massachusetts for the promotion of temperance.

**Dexter, Timothy**, American merchant: b. Malden, Mass., 22 Jan. 1743; d. Newburyport 22 Oct. 1806. He succeeded in amassing a large fortune for those days. He developed certain eccentricities which gave him great notoriety, assuming the title of Lord Timothy Dexter. For example, he constructed odd and bizarre residences in Newburyport, Mass., and Chester, N. H. The grounds of the first house were adorned with thirty or forty colossal wooden statues of famous men. He included himself in the number. He also made an extraordinary collection of absolutely worthless paintings, in order to prove his knowledge of art, and supported a poet who was supposed to be ready to sing his praises upon occasions. He wrote a book called 'A Pickle for the Knowing Ones' and also a pamphlet with all the punctuation marks printed upon the last page, there being none in the text proper.

**Dextrin** ( $C_6H_{10}O_5$ ), a body obtained from starch, and very similar to it in composition; also called starch gum, British gum, etc. It resembles gum in being soluble in water, but is distinguished from that substance by composition, by being, like starch, converted into oxalic

## DEXTROSE — DIABASE

acid by nitric acid, and not into mucic acid, and especially by causing a ray of polarized light to deviate to the right, a property from which it derives its name. It is prepared from starch by several processes. The transformation may be effected by dilute sulphuric acid at a temperature a little below that of boiling water. By acting upon starch with diastase (q.v.) dextrin is produced. To water at about 70° or 80° F., in a boiler, 8 or 10 parts of dried malt are added, and then 100 parts of starch after the heat is raised to 140° F. The mixture is kept stirred and the temperature maintained somewhat above this for 20 minutes, and then, when the thick mass has become quite fluid, it is raised to the boiling-point rapidly, cooled, the clear liquor filtered, and evaporated to a syrup. When cold it is an opaque gelatinous mass, which, on drying, becomes hard like gum. Dextrin is used in large quantities for thickening calico-printers' colors, for making adhesive paper and labels, and for postage stamps, as a varnish, and for many other purposes.

**Dextrose**, dēks'trōs, grape-sugar, starch-sugar, or dextroglucose,  $C_6H_{12}O_6$  or  $C_6H_7O(OH)_5$ . Dextrose occurs along with levulose in grapes and other sweet fruits, also in honey and in the urine of diabetic patients. It can be produced by the action of dilute sulphuric acid on cane-sugar, starch, cellulose, etc. It can be best obtained by boiling for several hours 50 parts of starch with dilute sulphuric acid (100 parts of water to 5 parts of  $H_2SO_4$ ). The solution is then neutralized with chalk, filtered, boiled with animal charcoal to remove traces of color, and then evaporated carefully to dryness, forming an amorphous mass which contains about 60 per cent of dextrose, the remainder being chiefly dextrin. Pure dextrose can be obtained by crystallization from alcohol; it contains then one molecule of water of crystallization, and forms microscopic rhombic crystals, which soften at 60°, melt at 86°, and lose their water of crystallization at 110°. Heated to 170° it is converted into glucosan ( $C_6H_{10}O_5$ ). Dextrose tastes much less sweet than ordinary canesugar. By the action of sodium amalgam on dextrose it is converted into mannite,  $C_6H_{14}O_6$ . A solution of dextrose becomes brown when boiled with caustic alkalis.

**Dey**, dā (from Turk. day, maternal uncle, a title of dignity), a title formerly given in the 17th century to the Turkish commander of the army in Algiers. The office was attained by seniority. When the French captured Algiers in 1830, the title and office were of course abolished. The title of dey as given to the governor of Tunis has long been replaced by that of bey. There still exists a dey of Tripoli.

**De Young, Michael Harry**, American publisher; b. St. Louis, Mo., 5 Oct. 1848. He received a common school education and in 1865 established with his father the 'Dramatic Chronicle,' subsequently merged into the San Francisco *Chronicle*, of which he has been sole proprietor since 1880. He was commissioner from California to the Paris Exposition of 1889, vice-president of the World's Columbian National Commission in 1892, and director-general of the California Midwinter Exposition of 1893. In the last named year he was made vice-chairman of the Republican National Committee.

**Dhalak**, dā-lāk', an archipelago of the Red Sea, off the coast of Abyssinia. It contains nearly 100 rocks and islets, mostly uninhabited, clustering round the island of Dhalak-el-Kebir. This island possesses a pearl fishery.

**Dhar**, dār, India, (1) a small native state in the Malwa agency, in the central part of India, with an area of about 1,740 square miles. The soil is fertile, and yields rice and other cereals. Pop. 169,474. (2) The capital, of the same name, is situated about 180 miles east of Baroda, and contains some striking buildings, and a fort built of red stone stands outside the town. Pop. 18,430.

**Dharangaon**, dār-ān'gā-ōn, India, city in the Khandesh district, Bombay, having a trade in cotton and oil-seeds, and manufactures of coarse cloth. Pop. 15,072.

**Dharwar**, dār'wār, India, city, capital of a district of the same name, in the southern Maharashtra country, in Bombay presidency. The city is a trade and dispensing station for the surrounding country. American cotton is raised successfully, and silk and cotton goods are manufactured in the district. Pop. 32,841.

**Dhawlagiri**, dā-wāl'ā-ghēr'ē, or **Dhaulagiri**, once supposed to be the highest peak of the Himalayas, has a height of 26,826 feet above the sea. It is in Nepal, in lat. 29° N., and lon. 82° 30' E.

**Dhole**, dōl, a local Indian name for the wild dog, native to parts of India. It is called 'buansu' in the Himalayas. See *Wild Dogs*, under Dogs.

**Dholera**, dō'lér a, India, city in the Ahmedabad district of Bombay presidency, on a stream entering the Gulf of Cambay, an important cotton mart. Pop. 10,088.

**Dholka**, dōl'ka, India, city in the Ahmedabad district of Bombay presidency, probably one of the oldest towns in Gujerat. The weaving of women's robes is the principal industry of the town. Pop. 16,494.

**Dhow**, dow, an Arab sea-going vessel, ranging from 150 to 200 tons burden, with one mast, a yard the length of the vessel, and a large lateen or triangular sail. It is used for merchandise and is often employed in carrying slaves from the east coast of Africa to Arabia.

**Dhulia**, dōo'lē-ā, India, the chief town of Khandesh district, Bombay presidency, situated on the south bank of the Panjhra River. There is a new and old town combined. It is a cantonment town. Pop. 21,880.

**Dhurra**, door'ra, or **Dourah**, Indian millet, the seed of *Sorghum vulgare*, after wheat the chief cereal crop of the Mediterranean region, and largely used in those countries by the laboring classes for food. Varieties are grown in many parts of Africa, one of them known as Kaffir-corn.

**Di'abase**, a word used by petrographers with varied meanings; but the present usage in this country restricts it to crystalline igneous rocks, of the basalt family, generally occurring as dikes, having as essential constituents plagioclase feldspar, augite and magnetite. Olivene may or may not be present. Diabases differ from the

## DIABETES INSIPIDUS — DIACAUSTIC CURVE

granitoid rocks, to which they have a somewhat similar texture, in that the crystals of feldspar are long and narrow, or lath-shaped, and the dark silicates are arranged in the interstices of the feldspar crystals, giving an ophitic texture. Diabases are of common occurrence in the United States. They form dikes and laccoliths at various places along the Atlantic seaboard from Nova Scotia to Georgia. The so-called traps of the Connecticut valley and the Palisades of the Hudson, are familiar examples. In the Lake Superior country diabases are of frequent occurrence; notably in the Marquette Iron Range and on Keweenaw Point; the latter sometimes carry native copper. The convenient field name greenstone, is frequently given to old, more or less altered, diabases. By pressure and shearing stresses, and the intrusion of other igneous rocks, diabases change to hornblende and chlorite schists, showing no trace of original structure. Such rocks are common in the Lake Superior region and elsewhere, along the Algonkian and Archæan rocks that characterize the formation of so much of northeastern North America. Diabases are of common occurrence in the Rocky Mountains also, and frequently, over deposits, are found along their contacts with sedimentary rocks, particularly limestones. The typical diabase of the Palisades contains: Si O<sub>2</sub> 53.13; Al<sub>2</sub>O<sub>3</sub> 13.74; Fe<sub>2</sub>O<sub>3</sub> 1.08; Fe O 9.10; Ca O 9.47; Mg O 8.58; Na<sub>2</sub>O 2.30; K<sub>2</sub>O 1.03. The specific gravity is 2.96.

**Diabetes** (dī-ā-bē'tēz) **Insip'idus**, a chronic disorder, characterized by the production of large quantities of urine of low specific gravity. It is a disorder particularly of young people, and is more frequent in males than in females. In the larger number of patients it seems to be of congenital origin. Its exact nature is unknown, although it seems to be related to some disturbance of the vasomotor mechanism in the kidneys. As a rule it is a disease of slow onset, the early symptoms being an increasing thirst and the passage of large quantities of urine. Occasionally there are pains in the thighs; the appetite is usually good; there is much thirst; the perspiration is small in amount, and the skin is apt to be rough and harsh. Otherwise the patients suffer but very little. It is a disease that is rarely prejudicial to health, having been known to persist for 50 years, and occasionally it passes away without treatment. Treatment is unsatisfactory.

**Diabetes Mel'itus**, a disorder of nutrition, in which there is deficient oxidation of the sugar in the body, which permits of the storing up of large amounts of sugar in the blood. This is eliminated in part in the urine, and there constitutes one of the most positive findings of the condition. It is a rare disease in America, but is less so in European countries, where it is from three to five times as common as here, although statistics seem to show that it is on the increase in the United States. The symptoms vary very widely. There is an acute form of the disease which proves rapidly fatal, but in the majority of cases there is a gradual onset, during which increased urination and increased thirst are the initial symptoms. Following this, if the disease progresses, the thirst still increases; there is passing of large quantities of urine containing glucose; very marked increase in the appetite, amounting sometimes

almost to voraciousness and gluttony; and an accompanying progressive emaciation. The skin is dry and harsh; temperature is often below normal; the tongue is bright red, and glazed; the gums may be swollen; and constipation is the rule.

As the disease progresses a number of complications are apt to arise; boils and pimples are extremely common; eczema and intense itching are frequent. Perforating ulcer of the foot may occur, and occasionally there is bronzing of the skin. Acute pneumonia is a frequent cause of death. Gangrene of the lung may also arise, and tuberculosis is contracted with great readiness. In most cases, particularly in the young, there is a form of progressive intoxication due to the gradual retention in the body of acids which are not properly neutralized by the body's protective agencies. There is gradually progressive anæmia, headache, delirium, great distress and marked hunger for air, which may be accompanied by blueness of the skin. Neuralgic pains are also frequent complications in diabetes.

The cause of diabetes mellitus is a matter of much inquiry, but it would seem that it is a disease of a number of origins. Fundamentally, however, it is due as implied at the beginning of this article, to some interference with the physiology of sugar-oxidation. This may result from disease of the pancreas, disease of the suprarenal gland, sometimes disease of the central nervous system, and occasionally disorder of the sympathetic system. The pancreas and the suprarenals are considered at the present time as the site of the chief changes leading to the production of this disease. The outcome is usually dark. In children, as a rule, it progresses rapidly to death. Middle-aged people may live for many years, but instances of cure in true diabetes are rare. The treatment is largely hygienic, and is extremely complicated. Diet and hygiene are the most important factors. Each patient having his idiosyncrasies, medical advice on the matter of diet is imperative. The patient, not the disease, needs treatment; hence general rules are more productive of harm than of good.

**Diabet'ic Sugar** (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>), formerly supposed to be a distinct species of sugar, now found to be the same as glucose (q.v.). It is regularly produced by the liver, and is a constant though trifling constituent of healthy urine, but in diabetes mellitus (q.v.) it amounts to 8 or 10 per cent. See INOSITE.

**Diablerets**, dē-ā-blē-rā, **Les** (Fr. "the little devils"), a secondary mountain group of the Bernese Alps, Switzerland, between the canton Vaud and canton Valais. The highest peak is 10,620 feet. Two peaks have already fallen, and others threaten to follow. The rocks consist of limestone, resting at a high angle on beds of shale, which becoming disintegrated leaves the limestone without support, and causes tremendous landslips. The most disastrous took place in 1714 and 1749. By the former the surrounding district was shaken as by an earthquake, and many human beings and cattle perished; by the latter the course of the Liserne was arrested, and two small lakes formed.

**Diacaustic** (dī-ā-kās'tik) **Curve**, a curve of intense light, formed by the consecutive intersections of rays refracted through a lens.

## DIACHYLON — DIAL

**Diachylon**, dī-āk'ī-lōn, a combination of oxide of lead or litharge, olive oil, and water. It is, in fact lead soap, insoluble in water, and sparingly soluble in alcohol, hard and brittle while cold, but soft on heating. It is used in surgery as the basis of adhesive plasters.

**Diadem**, a band for holding together the adjusted hair of the head, a wreath or chaplet for the head or forehead. In Oriental antiquity it was employed as a badge of royalty or nobility among the Egyptians, Assyrians and Babylonians. It was called *nefer* among the ancient Jews, and was worn as an ornament by kings and high priests, when it took the form of a golden circlet for the brows. Among the Persians, Armenians, and Parthians, the kingly and queenly diadem was a broad band of pale blue. Alexander the Great adopted this regal decoration after contact with the Persians, and his successors followed his example in this fashion. The Greeks early adorned their greater gods with the diadem, notably Zeus, Hera and Aphrodite, and it later became the universal ornament of their women, and their young men, especially the Olympic victors. These diadems were made of such various materials as metal and leather. Among the Romans Ancus Martius introduced the diadem from the Etruscans, but it was abolished on the expulsion of the kings. Which of the Cæsars revived its use is not known. According to some authorities Aurelian first assumed it. Its use among the non-Roman kings and princes of Europe appears to have been universal. Under Constantine the Great the imperial diadem was studded with gems and took a form which rendered it the prototype of the crowns worn by mediæval and modern monarchs.

**Diæresis**, dī-ēr'ē-sīs, in grammar, the resolution or separation into distinct syllables of two vowels whose juxtaposition has either caused them to coalesce or threatened them with coalition. In printing, a mark (¨) placed over the second of two adjacent vowels to indicate that they should both be pronounced: as, aërated.

**Diagno'sis** (Gr. from *dia*, through, and *gnōsis*, knowledge), in medicine, the discrimination of diseases. It includes the study of all the vital phenomena of diseases, and also of their appearances after death, in so far as this can aid their discovery during the life of a patient. It is usual to speak of rational or physiological diagnosis, or diagnosis by symptoms, that is, changes chiefly functional, observed by the patient; and of physical diagnosis, or diagnosis by signs, that is, objective phenomena appreciable by the senses of the observer. The latter method of diagnosis has been much enlarged in scope and increased in importance by the modern methods in medicine of auscultation and percussion (qq.v.) and also by the great advances made in physiological chemistry, and by the use of the microscope. Skill in diagnosis is one of the highest gifts of the physician.

**Diagonal, Diagonal Line**, a straight line joining two angles not adjacent, in a rectilinear figure. Every rectilinear figure of more than three sides may be divided by diagonals that do not intersect, into as many triangles as it has sides, minus two. To find the number of possible diagonals, take three from the number of

the sides, multiply the remainder by the number of the sides, and halve the product.

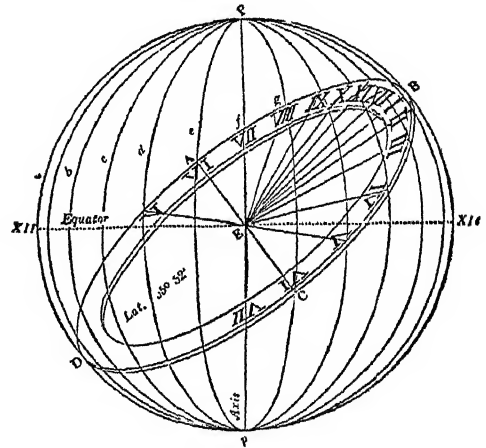
**Diagoras** (dī-äg'ō-ras) of Melos, Greek philosopher: d. Corinth about 412 B.C. He was a pupil of Democritus of Abdera. On account of his ridiculing the popular religion, he was charged with impiety, and received the surname of the Atheist. Fearing for his life, he fled from Athens and went to Pallene, and finally to Corinth.

**Diagram**, a figure or geometrical delineation applied to the illustration or solution of geometrical problems, or a description or sketch in general. Anciently, it signified a musical scale. Among the Gnostics the name diagram was given to a figure formed by the superposition of one triangle on another, and inscribed with some mystical name of the Deity, and worn as an amulet.

**Dial, The**, a famous American quarterly, the recognized organ of the Transcendentalists. It was published in Boston 1840-4. Its first editor was Margaret Fuller, 1840-2, assisted by George Ripley and Emerson, and for the remainder of its course it was edited by Emerson. It was reissued in 1902 with introduction by G. W. Cooke.

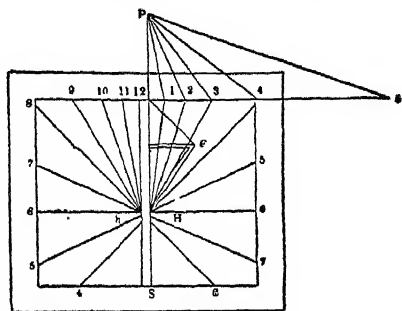
**Dial, Sun**, an hour-measuring instrument known from the earliest times to the Egyptians, the Chaldeans, and the Hebrews. The Greeks derived it from their eastern neighbors, and it was introduced into Rome during the first Punic war. The leading principles of dialing may be made intelligible to general readers by the following simple illustration.

Let P B  $\rho$  D represent the earth as a hollow transparent sphere, having an axis P E  $\rho$ , of



which P and  $\rho$  are the poles. Let the equator be divided into 24 equal parts, and through these divisions draw the meridians, a, b, c, d, etc. Let one of these meridians pass through any given place for which a dial is required to be made, and where that meridian cuts the equator let it be numbered XII. The opposite meridian must likewise be numbered XII, the other meridians being numbered as shown in the cut. This being done, these meridians will be the hour circles of the place on the first meridian; so that if the axis P E  $\rho$  were opaque, the sun

• • •



We have been considering the earth as the sphere, in our illustration of the nature of dials, but the earth's magnitude is so small compared with the distance of the sun, that no sensible error will follow in considering a small glass sphere similar to that above described, but placed on the surface of the earth with its axis parallel to that of the earth; then will the sphere show the hour of the day in the manner before specified. The only things absolutely essential for a dial are the axis and the plane, the places of the hour lines having been once determined. Dials may have various forms, many of which are exceedingly curious and intricate, and require for their construction the application of complicated trigonometrical formulæ. We shall confine our attention here to the most common, and, at the same time, most useful form, that is, the plane horizontal dial. On the proposed plane, which may be either of marble, slate, or brass, draw the straight line P H S for the meridian or 12 o'clock line, and parallel to this draw 12, h S, leaving a space between them equal to the thickness of the gnomon. The gnomon is a thin triangular plate of metal, somewhat similar in shape to the figure A E B, the side A B being fixed into the plate of the dial, so that the gnomon shall stand perpendicularly, the line A E being directly north and south. The line A E is called the style, and the angle E A B is equal to the latitude of the place for which the dial is constructed.

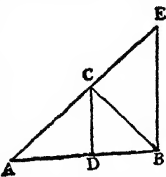
2. Draw 6 H 6 perpendicular to 12 H S, and it will be the 6 o'clock hour line; make the angle 12 H F equal to the latitude of place, and draw

$$I_2, \begin{matrix} I, & 2, & 3, & 4, & 5, & 6, & 7, & 8, \\ II, & IO, & 9, & 8, & 7, & 6, & 5, & 4. \end{matrix}$$

The sun-dial is daily getting more rare in this age; but notwithstanding the superiority of the clock, why has the dial almost everywhere vanished? "If its business use," as has been well observed, "be superseded by more elaborate inventions, its moral use, its beauty, might have pleaded for its continuance. It spoke of moderate labors—of pleasures not protracted after sunset—of temperance and good hours. It was the primitive clock—the horologe of the first world. Adam could scarce have missed it in paradise. It was the measure appropriated for sweet plants and flowers to spring by—for the birds to apportion their silver warblings by—for flocks to pasture and be led to fold by. The shepherd carved it out quaintly in the sun, and, turning philosopher by the very occupation, provided it with mottoes more touching than tombstones."\*

Although the use of provincial dialects becomes inconvenient after a language has

\* "*Horas non numero nisi serenas*" ("I only count the hours of sunshine") was an ancient motto of great beauty and significance.





## DIALECTICS — DIALOGUE

acquired a fixed literary standard, the study of such dialects is always valuable to the philologist for the light they throw on the history of the language. They frequently also retain beauties which have been lost in the received language, and with which, when they admit of being restored, it may still be enriched. No one who has studied the peculiarities of the Provençal, the Low-German, or the Alemannic dialects, or the Neapolitan, with its many remnants of the Greek, can be insensible of the interest and value of such investigations.

Italian was once the vulgar dialect; and, even now, to translate into Italian is called *volgarizzare*. It was corrupt Latin mixed with barbarous words derived from the idioms of the conquerors of the country, and was used at first only by the lower classes; it then became the general dialect of common life; and at last Dante dared to adopt the "vulgar dialect," and to stamp it as a legitimate language.

Spanish and Portuguese were cognate dialects, and might, like the different dialects of the Spanish provinces, have become one language, if the two nations had not been separated politically.

In Germany no dialect has ever obtained entire ascendancy. Much was once written in Low-German, and the activity of the Hanseatic League, and the wide extent to which it was spoken, gave it much influence. Charles V., born at Ghent, spoke Low-German; but Luther's translation of the Bible, like Dante's 'Divina Commedia,' made High-German the literary language. Only the fundamental characteristics of the language of Upper Germany have remained in High-German. In other respects it has developed itself independently of any provincial dialect.

Of English there are but two distinct literary dialects, the modern English and the Scottish, which is derived from the same Saxon stock. It has often been observed, however, that no country has more variations from the common literary language. The Scottish dialect exists in its purity only in the early poets, historians, and other writers of the country. Most of the modern literary Scotch is only a hybrid English made up by an infusion into the common language of local words and colloquial expressions. Every county has its peculiarities, which are sometimes striking and difficult to be understood. It is evident that, although there never has existed a country so vast, and a population so large, as that of America, with so little variety of dialect, the work of development and decay is palpably going on in American Anglo-Saxon. To begin with, the dialect of the French Canadian is vivid and picturesque. That there are several distinct dialects in the United States is proved not only by the dialect literature of the East, the West, and the South, and dialect of the slums in New York, but also by the scientific publications of the American Dialect Society. The 'Dialect Notes' of this society furnishes much valuable information on this subject, and 'The Ithaca Dialect,' in which a local New York State dialect has been investigated by O. F. Emerson shows that the differentiations of language in distinct sections will some day furnish abundant and interesting material for the student of dialect.

**Dialectics** (literally, the art of conversation, debate, dispute, exchange of ideas in dialogue), hence the art of reasoning. By Socrates every inquiry was pursued between disputants, or controversialists, catechetically, that is, by proposing and answering questions. The great dialectic weapon of Socrates was a question which forced the man to whom it was proposed so to answer as to surrender the position he had first maintained, and admit the conclusion of his adversary. This was the famous Socratic elenchus. The dialectics of Aristotle comprise the doctrine of simple words, delivered in his book of 'Predicaments'; the doctrine of propositions, contained in his book, 'De Interpretatione'; and that of the several kinds of syllogism, in his books of 'Analytics,' 'Topics,' and 'Elenchuses.' The great instrument of Aristotle was the syllogism, invented and elaborated by him, the radical principle of which is, what is true of a whole is true of its part. The syllogism afterward became the main instrument of dialectics to the schoolmen, and until the time of Bacon, the accredited line of thought on which to enlarge the field of human knowledge. In modern times various systems of dialectics have been propounded in different countries; but by no philosophers, either ancient or modern, has this science been more cultivated than by the Germans, who, among a host of other names more or less distinguished, can boast of Fichte, Kant, Leibnitz, Hegel, Schelling, and Schlegel, as the propounders each of a dialectical system.

**Di'aling**, the art of making sun dials; also the art and practice of mine-surveying, in which the theodolite, magnetic needle, etc., are employed. See DIAL, SUN.

**Diallage**, *dī'āl-lāj*, a variety of the mineral pyroxene, near diopside in composition and therefore a calcium-magnesium silicate. It is easily altered by uraltization (see URALITE) to smaragdite. It has a distinctly lamellar structure, is usually of grayish to grass-green or brown color and pearly or metalloidal lustre. Its hardness is 4, and specific gravity about 3.3.

**Di'ologue**, a conversation or conference between two or more persons. The word is particularly used in reference to theatrical performances, and to written conversations, or a composition in which two or more persons are represented as interchanging ideas on a given topic. The ancient philosophers, especially the Greeks, from their peculiar vivacity were fond of this form; they used it for the communication of their investigations on scientific subjects. The dialogues of Plato are a sort of philosophical drama. The Socratic dialogue consists of questions and answers, and the person questioned is obliged, by successively assenting to the interrogatories put to him, to come to the conclusions which the questioner wishes to produce. The Socratic method has been adopted in modern times as a means of instruction in certain schools. Lucian claimed to be the inventor of humorous dialogue (see DIALOGUES OF THE DEAD). Erasmus of Rotterdam, and subsequently, among the Germans, Lessing, Moses Mendelssohn, Engel, Herder, Jacobi, Solger, have written in this form. In comic and satiric dialogue Wieland has imitated Lucian. Among the most distinguished Italian

## DIALOGUES OF THE DEAD—DIAMOND

writers of dialogue are Petrarch ('De vera sapientia'), Machiavelli, Gelli, Algarotti, and Gozzi; and among the French, Sarrasin, Malebranche, Fénelon, and Fontenelle. Among the English, Bishop Berkeley and Hurd have imitated Plato, and Harris, Cicero. Lord Lyttelton's 'Dialogues of the Dead,' and Addison's 'Dialogues on Medals,' are well known, but Landor's 'Imaginary Conversations' is the finest production in English belonging to this class of works. In the drama, the dialogue, in a narrower sense, is opposed to monologue or soliloquy; in the opera, it is that which is spoken, in opposition to that which is sung.

**Dialogues of the Dead**, satirical dialogues by Lucian (q.v.), written at Athens during the latter half of the 2d century. They have been frequently translated from the days of Erasmus to the present. The scene is laid in Hades. Among the characters introduced or referred to are: Menippus and Diogenes, the Sophists, and the Cynics, Aristotle, Alexander, Socrates, and Croesus. The decadent Olympian religion is exposed to ridicule, and it is demonstrated that the conception of fate logically destroys moral responsibility. In the dialogue regarding Charon and his passengers, the futility of riches and fame is shown, only sterling moral qualities availing in the shadowy land of Hades. Lord Lyttelton also wrote 'Dialogues of the Dead,' introducing some modern *dramatis personæ*, including Cortez, William Penn, Ximenes, Wolsey, Boileau, and Pope; and Fontenelle's 'Dialogues des Morts' should be noted as embodying a similar idea.

**Dialysis**, the separation of the crystalloid constituent elements of a mixture from the colloid, the former being bodies which diffuse readily, such as sugar, salt, bichromate of potassium, etc.; the latter bodies which diffuse with difficulty or not at all, bodies resembling glue or gelatin, such as gum, starch, caramel, albumen, the ordinary constituents of food, etc. The dialysis is effected by pouring a mixed solution of crystalloid and colloid on a sheet of parchment paper stretched over a wood or gutta-percha hoop, having its edges well drawn up, and confined by an outer rim. The parchment is allowed to float on a basin of water. In a short time all the crystalloid bodies will have passed through the membranous septum into the pure water, while the colloid matter will remain almost entirely in the dialyzer.

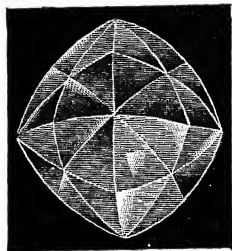
**Diamagnetism**, the moving of bodies such as iron, when placed in a field of magnetic force, from places of weaker to places of stronger force. The opposite is true of bismuth and other substances. Such substances are said to be diamagnetic. See MAGNETISM.

**Diamantina**, Brazil, a city lying somewhat north of the centre of the state of Minas Geraes, in a region formerly well known on account of its abundant production of diamonds. At the present time the wealth of the state is derived from agricultural and manufacturing industries; nevertheless Diamantina continues to prosper, being well situated with reference to the São Francisco River system, and the routes of travel between Rio de Janeiro and the interior. Its climate is good, owing to its elevation above sea-level (about 4,000 feet). Pop. (1901) 14,000.

**Diam'eter**, a straight line drawn through the centre of a circle, and terminated both ways by the circumference. It thus divides the circle into two equal parts, and is the greatest chord. The radius is half this diameter, and consequently measures the distance between the centre and circumference of a circle. The length of the diameter is to the length of the circumference of the circle as 1 is to 3.14159265 . . . , the latter number being an interminable decimal.

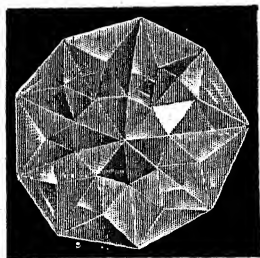
**Diamond**, a natural form of carbon, highly valued as a precious stone when transparent and of the crystalline form. It is of less

value than the ruby, and rubies of from two to four carats are frequently worth twice or four times the value of fine diamonds. A diamond crystallizes in the cubic or monometric system, its common form being the regular octahedron or a modification of it. The faces are often curved and the general form of the crystal is more or less rounded. The surface of the diamond frequently exhibits striae and triangular impressions, while the interior may contain microscopic cavities and various inclusions, often black carbon. It is the hardest substance known, but in spite of this hardness it is very brittle and cleavable; specific gravity, 3.52. It is generally colorless, but sometimes tinged with pink, red, orange, yellow, green, blue, brown, or black. Blue, red, and green are exceedingly rare colors. The finest deep red diamond known is that in the possession of the Russian crown, purchased in the time of the Emperor Paul of Russia. Light yellow, straw, and brown are the most common colors; rich yellow and browns are also highly prized. Some bluish-white Brazilian diamonds are phosphorescent in the dark after exposure to the sunlight. The color is attributed to the presence of a possible hydrocarbon, called Tiffanyite. This phosphorescence is a property peculiar also to alizarin. The brilliancy of the gem is caused by the black planes reflecting all the light that strikes them at an angle exceeding  $24^{\circ} 13'$ . The index of refraction is 2.439, being exceeded only by that in chromate of lead and orpiment. The diamond is unaffected by any liquid and infusible at the highest attainable temperature. It gradually burns away before the oxy-hydrogen blowpipe, or in the electric furnace, or when it is heated red-hot and plunged into an atmosphere of oxygen, carbonic acid then being produced. Exposed to the intense heat of the voltaic arc, the diamond becomes converted into graphite. Be-



Natural Crystal.

The surface of the diamond frequently exhibits striae and triangular impressions, while the interior may contain microscopic cavities and various inclusions, often black carbon. It is the hardest substance known, but in spite of this hardness it is very brittle and cleavable; specific gravity, 3.52. It is generally colorless, but sometimes tinged with pink, red, orange, yellow, green, blue, brown, or black. Blue, red, and green are exceedingly rare colors. The finest deep red diamond known is that in the possession of the Russian crown, purchased in the time of the Emperor Paul of Russia. Light yellow, straw, and brown are the most common colors; rich yellow and browns are also highly prized. Some bluish-white Brazilian diamonds are phosphorescent in the dark after exposure to the sunlight. The color is attributed to the presence of a possible hydrocarbon, called Tiffanyite. This phosphorescence is a property peculiar also to alizarin. The brilliancy of the gem is caused by the black planes reflecting all the light that strikes them at an angle exceeding  $24^{\circ} 13'$ . The index of refraction is 2.439, being exceeded only by that in chromate of lead and orpiment. The diamond is unaffected by any liquid and infusible at the highest attainable temperature. It gradually burns away before the oxy-hydrogen blowpipe, or in the electric furnace, or when it is heated red-hot and plunged into an atmosphere of oxygen, carbonic acid then being produced. Exposed to the intense heat of the voltaic arc, the diamond becomes converted into graphite. Be-



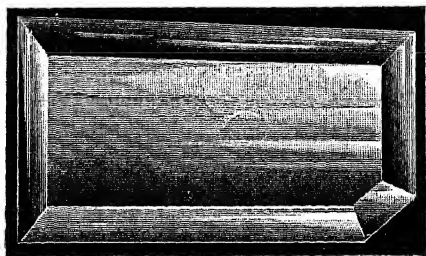
Florentine Crystal.

When it is heated red-hot and plunged into an atmosphere of oxygen, carbonic acid then being produced. Exposed to the intense heat of the voltaic arc, the diamond becomes converted into graphite. Be-

## DIAMOND

sides its value as a gem it is of great use in the arts and manufactures. Diamond dust is used for cutting and polishing other gems, for slicing gems of all kinds, agate, jade, and other hard substances. The edge of a native crystal rounded is used by glaziers for cutting glass, for engraving glass, steel, and other substances; the cut is generally to a depth of only 1-100 of an inch, but determines the direction in which the glass shall break; a cut of this depth, while scarcely showing, breaks well, whereas a deep scratch does not. A sharp point is used for engraving on glass and other hard substances; a splinter is also used as a tool for turning glass lenses in a lathe; and rough diamonds, too imperfect to be used as gems, are mounted as boring tools for perforating the softer rocks. In the amorphous black variety, carbon, carbonado, or bort is used for boring hard rocks; it sells for \$30 a carat, the value per carat of a fine transparent rough diamond of from one to two carats, as scarcely  $33\frac{1}{3}$  to 40 per cent of the crystals is left in the gem after the operation of cutting.

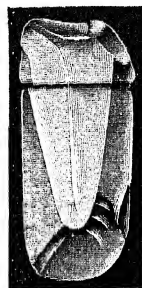
Originally diamonds were preserved in their natural form, but in 1456 Louis de Berquin or Bruges discovered the art of polishing them on rotating disks with diamond dust. These circular disks, about 10 centimetres in diameter, are of soft steel covered with diamond dust and oil, and made to revolve at 3,000 revo-



Great Table Stone of India.

lutions a minute. This gives the diamonds the artistic smooth surfaces and sharply defined edges. They are secured in a fusible metal dop or holder, held by a metal clamp to the wheel. The process is slow and tedious, and requires great skill to produce fine results. Until a few years ago Amsterdam was the great diamond-cutting centre of the world, but the finest cutting is now done in the United States, and in a great measure by machinery. As to the cutting process: Diamonds are, first, cleaved; that is, along the line of cleavage of the stone a tiny cut is made by rubbing the stone with another diamond at the point where it is desired to cleave it, then a dull knife-edge is placed in the cut, and a sharp blow will separate the stone on a cleavage plane. Secondly, diamonds are cut by rubbing two diamonds together ("diamond cut diamond," as the old adage says), the stones being cemented with shellac to two pieces of wood or handles which are held in the hands, and rubbed together till they are of the desired form. This also has been superseded partly by an American machine. The diamond-cutting trade is carried on by 8,000 jewelers, and over 30,000 people are employed in preparing and

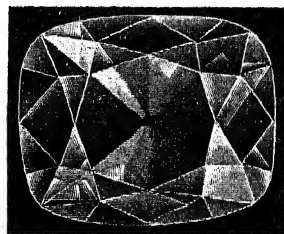
setting the gems. A "rose" diamond is one which is quite flat underneath, with its upper part cut into 12 or more little faces or facets, usually triangles, the uppermost of which terminates in a point. A "table" diamond is one which has a large rectangular face on the top, surrounded by four lesser rectangles. A "brilliant" diamond is one which is cut in faces both at top and bottom, and the table or principal face of which is flat; there are 32 faces on the top above the girdle, and 24 on the back, exclusive of the table on the top and the inlet on the back, 58 in all. The greatest amount of brilliancy and beauty is developed in the diamond by the "brilliant cut"; 98 per cent of all modern cut diamonds are cut in this form. Very few are at present "rose cut" or "table cut," though rose cut has been more or less in vogue from the 17th century; table cut was in vogue during the 15th and 16th centuries. The finest brilliant in the world to-day is the "Jubilee" diamond, shown at the Paris Exposition of 1900; this was a brilliant of 239 carats of wonderful brilliancy and purity, and was found at the Jagersfontein mine in South Africa.



The Shah.

Diamonds of from 1 to 22 carats each have been found in 24 localities in the United States. The combustibility of diamonds was proved in 1694 by Averani and Targioni with the aid of burning glasses. That diamonds turned to carbonic acid when burned was proved by Lavoisier in 1772. Many curious superstitions are connected with the diamond. It was supposed to show phenomena of sympathy and antipathy. It was fallaciously believed that the diamond, which resisted the two most powerful things in nature, iron and fire, might be destroyed by the blood of a goat; that, if it was macerated in fresh blood, it could not be destroyed by being struck on an anvil, etc. It was believed also to show a curious rivalry with the magnet, to strengthen poisons, and sometimes to drive away madness.

That the diamond was known to the ancients is extremely problematical. Only two diamonds are mentioned by Castellani as existing in antiquity in a small gold statue, and even this allusion is doubtful. Therefore we may safely say that when the Prophet Jeremiah speaks of diamonds under the name of shamir as a tool for engraving; when Ezekiel and Zechariah compare the stubbornness of the Israelites to the diamond, and when the Greeks and Romans speak of the stone under the name of *adamas* or *adamant*, the "unsubduable," the stone referred to was really the corundum. There does not exist in a single antiquarian collection in Europe a stone of the mineral which we now call diamond; the earliest authentic specimen known

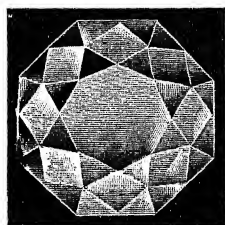


Star of the South.

## DIAMOND

being the stone set in the ring of Charlemagne, an octahedral diamond. Any other reference can only mean the corundum or sapphire, the stones which are next in hardness to the diamond, and which could both have been used for engraving nearly all the gems of the time. Pliny mentions this stone as being the most valuable of the possessions of man.

Authors and composers of Eastern tales long wrote of diamonds as being found in India only, and chiefly in the mines of Golconda—a misnomer, as Golconda was the market, not the mine; and diamonds from many mines were sold there. But ever since the year 1728 these stones have been found in great abundance in Brazil, no less than 1,146 ounces having been taken from there to Europe in 1730. In 1829 a vein of diamonds was discovered in the Ural Mountains; and in 1867, in South Africa, John

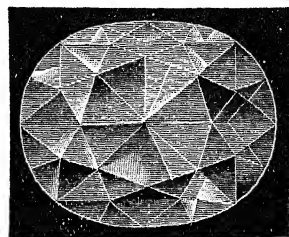


The Pasha of Egypt.

O'Reilly, a trader and hunter, reached the junction of two rivers, and stopped for the night at the house of a farmer named Van Niekerk. Children were playing with some pebbles they had found in the river. O'Reilly took one of these pebbles to Dr. Atherstone at Cape Town, who said that it was a diamond of 22½ carats. It was sold for \$3,000. Niekerk remembered that he had seen an immense stone in the hands of a Kafir witch-doctor, who used it in his incantations. He found the man, gave him 500 sheep, horses, and nearly all he possessed for the stone, and sold it the same day to an experienced diamond buyer for \$56,000. This was the famous "Star" of South Africa. It weighed 84½ carats in the rough, and was found to be a gem quite the rival of an Indian stone in purity and brilliancy. After it had been cut it was bought by the Earl of Dudley, and is now known as the Dudley diamond. By 1869, parties in ox-wagons had worked their way over the plains to the Vaal River. Soon a tented city of 12,000 or more foreigners grew at Pniel and Klipdrift, on the opposite banks of the stream, where diamonds were found plentifully. Soon hundreds of cradles, like those used by the Australian gold-diggers, were rocking on the edge of the stream, supplied with the precious gravel by a large force of diggers, sievers and carriers. The mines at Kimberley, 600 miles from Cape Town, are of exceeding value, the richest in the world. The output of a single mine, the "Kimberley," is \$4,000,000 annually, and within 10 years this district has yielded about \$58,000,000 in dividends. Ninety-five per cent of all the diamonds produced in the past 20 years came from South Africa; of these over 90 per cent came from the De Beers mines, limited, a consolidation of all the African mines in and about Kimberley; 5 per cent from the Orange River Colony and elsewhere, the latter usually of great purity. The capitalization of the De Beers mines is at the present market value about \$100,000,000.

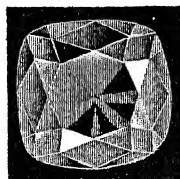
Most of the miners are natives, who are kept in compounds for periods of from three to six

months; this system has broken up the illicit diamond buyers' ("I. D. B.") system, which seriously threatened the successful working of the mines. The chairman of this syndicate was Cecil J. Rhodes (q.v.), who by his genius and will created the corporation apparently out of chaos, and regulated the value of diamonds for over 12 years, the result being of great benefit to the jewelers of the world. The buying and selling of the gems is controlled by the government. Since the organization of the De Beers mine, in 1888 to 1 Jan. 1900 there have



The Kohinur.

been mined 35,000,000 loads of earth of 1,600 pounds each; these have yielded 31,000,000 carats of diamonds, valued at \$200,000,000. The total African yield from the opening of the mines to the present is about \$350,000,000, after cutting \$700,000,000 worth of diamonds. Since 1867, duty has been paid on \$240,000,000 worth of diamonds and precious stones, and it may be safely said that \$500,000,000 worth are owned in the United States.

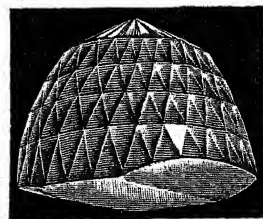


The Polar Star.

The total value of all the diamonds known to exist in the world to-day is at least \$1,000,000,000. Therefore it may safely be said that one half of all the diamonds known are owned in the United States.

Most of the great diamonds distinguished for beauty and size have very interesting histories. One of the most famous is the Kohinûr, or Koohinoor, "Mountain of Light." The legend is that it was carried 5,000 years ago by the hero Karna, whose deeds are celebrated in the "Mahabharata." It made its first appearance in history in the 14th century, when Ala-ed-din brought it to Delhi. At that time it was supposed to weigh 793 carats. When in 1673 the Grand Mogul sold it to Tavernier, it weighed only 279 carats, having been injured by the lack of skill of a Venetian lapidary. It was brought in 1739 at the sack of Delhi to Afghanistan. Thence it came into the possession of the East India Company, which presented it in 1850 to the English crown. It was recut in 1852 and now weighs 106 1-16 carats.

What is said to be the largest stone in the world was sent to London from the Jagersfontein mines in South Africa in 1893. It weighed 971 carats or nearly half a pound, and was three inches in length. It is in process of being cut in Amsterdam, and is of a fine color. Another



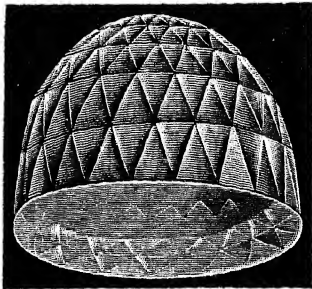
The Orloff.

## DIAMOND

weighed 640 carats. A pre-historic diamond mine is believed to have been discovered near Winburg in the Orange River Colony, a hundred feet in depth and with tunnels branching off for several hundred feet. In these were found primitive tools, armor and weapons, and the skeletons of men who must have been above the average stature of any race of the present day. The natives have no traditions concerning them.

Another important diamond is the one at the point of the sceptre of the Russian empire, known as the Orloff, which weighs 194¾ carats. At one time it formed the eye of an idol in the temple of Seringham in Mysore, whence it was stolen. It was in the throne of Nadir Shah, and after his murder it was bought by an Armenian merchant in 1772 at the price of 450,000 silver rubles and the title of nobility. By the gift of Prince Orloff, a favorite of Catharine II., from whom it derived its name, it came into her possession. Some writers think that this and the Koh-i-Nür are the two parts of the "great mogul" diamond. The supposed great diamond of the king of Portugal, 1,770 carats, is a rolled oval pebble of white topaz.

The Regent or Pitt diamond was, till the recent opening of the South African mines, for over a century, one of the most perfect and beautiful diamonds in existence. It weighs



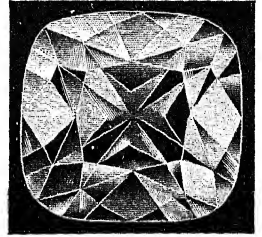
The Great Mogul.

136.75 carats, and is of the purest water and most perfect shape. It came from the East Indies and was sold by a sailor to Pitt, governor of Ft. St. George. From him it came into the hands of the Duke of Orleans at the

time of the French revolution. It was in pawn at the hands of a merchant by the name of Trescow. Afterward it decorated the sword hilt of Napoleon I., and is now in the Galerie d'Apollon in the Louvre.

One of the finest of diamonds is the Sancy diamond, 53½ carats, of exquisite shape and perfect water. It has been traced back to Charles the Bold, who lost it in 1477 at the battle of Nancy. It came through many private hands to the Huguenot nobleman Sancy. When Sancy was sent as an ambassador to Solothurn, he received from Henri III. the command to send to him that diamond as a pledge. The servant to whom it was entrusted was attacked and murdered, but instead of giving up the diamond he swallowed it. Sancy had the body opened and found the precious diamond in his stomach. James II. procured it when he came to France in 1688. Later it came into the possession of Louis XIV. and was worn by Louis XV. at his coronation. In 1835 it was sold to the Russian emperor for 500,000 rubles. In 1865 it came into the hands of Sir Jamsetjee Jeejeebhoy, and in 1889 was again in the market; the price asked was 100,000 rubles. It is owned by a collector, who paid \$70,000 for it.

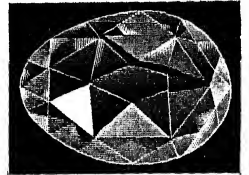
One of the most superb diamonds known is the sapphire-blue brilliant Hope diamond, valued at about \$100,000. It is believed to have been cut from a blue diamond weighing in the rough 112½ carats, sold by Tavernier to Louis XIV., and which disappeared in the troubles of 1792. The largest diamond ever found in Brazil weighed 254½ carats, and was discovered in 1853 by a negress in the river Bogageno; it is known as the "Star of the South." It was sold to the Gaekwar of Baroda for \$450,000.



The Regent or Pitt.

From 1750 to 1870 the value of a diamond was fixed on a basis of the square of its weight; that is, a 1-carat stone was worth \$100, a 10-carat stone was worth—10 x 10 x 100—\$10,000. This was due to the fact that large stones were rare. But in the African mines, large stones are found, and the increase in value from one carat up is worth only a fraction more per carat than the carat weight would show. When brilliants are exceedingly small the value per carat may be double that of stones weighing one sixteenth to one fourth carat each, owing to the difficulty of cutting. The term "first quality" signifies a stone absolutely white and free from all flaws and imperfections. Imperfections, even if slight, or a tint of undesirable colors, greatly lower the value of a diamond.

As the diamond is known to be nothing but a crystalline form of common carbon, many attempts have been made to manufacture it by artificial means. No great degree of success has yet rewarded these efforts, although very small diamonds of apparently good quality can be prepared by methods now known. Carbon being practically infusible, it has not been found feasible to induce crystallization by causing the carbon to solidify from a molten condition. Free carbon is soluble in but few substances, and from such solutions as can be prepared it is deposited mainly in the form of graphite. It dissolves to a considerable extent in melted platinum, but when the metal is allowed to cool and solidify, the carbon is all thrown down as graphite, and no diamonds are obtained. Of the more successful experiments of this sort, those of Moissan are best known. Moissan made use of the known fact that carbon will dissolve to some extent in melted iron. Under ordinary conditions the carbon is here also deposited in the graphitic form; but Moissan found that when the solution is allowed to cool under an exceedingly great pressure a small portion of it appears in the form of minute crystals that possess all the properties of the true diamond, even exhibiting the peculiar pittings on the surface that are characteristic of the natural stone. His method consists in saturating the molten iron with carbon and then pouring it into a mold, and chilling the casting



The Sancy.



## DIAMONDBACK TERRAPIN — DIAMOND INDUSTRY

as quickly as possible by immersing it in water. The outer layers solidify under this treatment, while the interior is still quite fluid, and the powerful contraction of the surface gives rise to an enormous internal pressure. As the fluid core solidifies, the greater portion of the carbon that it contains is deposited in particles that are distributed throughout the mass. The casting, when entirely cool, is dissolved in acids, and the residue is treated in various ways to effect the removal of the graphite and amorphous carbon. A small precipitate remains behind, in which tiny crystals of diamond may be distinguished. No stones that are large enough to be of commercial value have yet been prepared, and while the process is of great theoretical interest, it is far too expensive, in comparison with the yield, to be practicable even for the manufacture of diamond powder for polishing and grinding purposes.

GEORGE F. KUNZ.

**Diamondback Terrapin** (*Malaclemmys palustris*). This far-famed turtle belongs to the family *Emydidæ* (q.v.) and may be recognized by the unhinged plastron or lower shell, the concentric grooves and ridges which mark each plate of the upper shell or carapace, the smooth unnotched jaws, smooth skin covering the head, and dark olive or black color. Unlike most terrapins, the diamondback inhabits salt and brackish waters, living in the marshes which fringe our seacoast from Cape Cod to Texas. Formerly very abundant throughout this region, the constant extensive fishing to supply the markets has greatly reduced its numbers, so that the problem of its artificial propagation is now being taken up seriously. The principal fisheries are in Chesapeake Bay and on the coasts of New Jersey and North Carolina. Although a considerable number are dug from the mud while hibernating, a much larger proportion are captured by means of traps, seines, etc., during the summer months, and are confined in pens, where they are fed on oysters, fish, and celery to fatten them for the winter market. From the point of view of the epicure, the diamondback is perhaps the most famous and esteemed product of American waters, and during the season of greatest demand commands almost fabulous prices. Those commonly sold have a length of shell of from five to eight inches, and are supposed to be from 6 to 10 years old. The habits differ but little from those of other terrapins. They are omnivorous, lay their eggs in June and July in small nests excavated in some warm sandy bank, and hibernate during the winter after burying themselves a few inches beneath the mud. See TERRAPIN.

**Diamond-beetle**, the *Entimus imperialis*, a splendid coleopterous insect belonging to the family *Curculionidæ* or weevils. The ground color is black, but the insect is covered by a large number of scales which appear brilliantly green by reflected light. It is very abundant in some parts of South America.

**Diamond-bird**, an Australian bird (*Pardalotus affinis*), of beautiful plumage, receiving its English name from the peculiar markings of its feathers. Its general color is gray and white, but spotted with red, yellow, orange, and black. It makes its nest in old tree-trunks, and

sometimes burrows in the ground, or utilizes any chance excavation. It feeds on insects.

**Diamond Gauge**, a gauge for estimating the size of diamonds. In the staff are set crystals of graduated size, by which jewels are compared. The crystals are from one quarter to one sixty-fourth of a carat.

**Diamond Industry**, a most important and far-reaching department of national and international commerce, which is spreading and increasing, year by year, especially in the United States. The diamond has been a precious stone procured with difficulty, treasured up with jealous care, and sought after by the rich and magnificent for ages. Diamonds are also indispensable for instruments employed in some of the manufacturing and industrial arts. A consideration of the diamond industry must include an account of the mining, polishing, importation, and sale of this gem. The distribution of diamonds in the geological formations of the world, their mining, etc., has been dwelt upon under the article DIAMOND (q.v.). It remains to point out some recent industrial facts of importance, with regard to the separation of diamonds from the concentrates, which remain when the diamantiferous earth has been washed, after being brought to the surface at Kimberley; their importation to this country, and their artificial manufacture. In mining diamonds, it was necessary until recently to go very carefully over the concentrates to pick out the garnets and many other foreign substances until nothing remained but the rough diamonds. This is a slow and laborious operation, but it has been an essential part of the mining industry until it was superseded by a discovery made a while ago. The discoverer was Mr. Fred Kersten, one of the employees in the sorting room. His discovery was accidental. A rough diamond and a garnet happened to be lying on a small board on the bench where he was working. He happened to pick up one end of the board when the garnet glided off, but the diamond remained. Kersten found that there was a coating of grease on the board which had retained the diamond, while the garnet slipped off. He procured a wider board, coated one side of it with grease and dumped a few handfuls of concentrates on it. Then he found that by holding the board in a slightly inclined position and vibrating it, all the concentrates except the diamonds moved to the lower end and fell off while the diamonds remained in place. Then he invented a machine by which his discovery might be utilized. The invention was an entire success. All the garnets and other minerals that are not wanted pass over the surface of the table, while every diamond, large or small, is retained. The entire work is now done by machinery, and both the young inventor and the owners of the diamond mines are profiting by the new labor-saving device. The United States is a very large purchaser of diamonds. One third of the entire amount of cut stones is owned in this country. The importations are increasing.

More than \$30,000,000 worth of diamonds and other precious stones were brought into the United States last year according to the statistics of the Department of Commerce and Labor. This is the largest importation of diamonds and other precious stones ever shown in a single year of United States commerce. Prior to 1887



## DIAMOND INDUSTRY

the total had seldom, if ever, reached \$10,000,000 per annum; from 1887 to 1893 the total gradually moved upward until it reached \$16,000,000; then it rapidly fell to \$5,500,000 in 1894, \$7,500,000 in 1895, \$6,750,000 in 1896, and \$2,500,000 in the fiscal year 1897. In 1898 the total increased to nearly \$9,000,000, in 1899 to over \$14,000,000, in 1901 to \$20,000,000, in 1902 to \$23,000,000, and in 1903 will be fully \$30,000,000, making the total for the year just ended not only more than in any preceding year, but 50 per cent in excess of 1901, double the figures of 1899, and more than six times the average during the period 1894-7.

This rapid growth in the importation of diamonds, while it suggests general prosperity, also seems to indicate the development of a comparatively new industry in the United States—the cutting of diamonds. The total importations of diamonds alone in the 11 months ended with May amounted to \$24,000,000, and of other precious stones \$4,500,000. Of the \$24,000,000 worth of diamonds imported, \$10,000,000 were uncut diamonds; this total of \$10,000,000 of uncut diamonds is a large increase compared with the importations of uncut diamonds in preceding years, the figures for 11 months of the year 1902 being \$5,500,000, while for the corresponding period of 1901 they were \$6,500,000, for the corresponding months of 1900 \$3,500,000, and for the corresponding months of 1898 but little over \$2,000,000.

The diamonds imported are divided by the bureau of statistics statements into two groups, namely: "Diamonds uncut, including miners', glaziers', and engravers', not set," and "Diamonds cut, but not set." The value of diamonds uncut, including miners', glaziers', etc., imported in 11 months ended with May has grown from \$2,500,000 in 1898 to \$10,000,000 in 1903, while that of diamonds cut but not set has grown from \$4,000,000 in 1898 to \$14,000,000 in 1903, these figures being in each case for the period of 11 months. This inference that the cutting of diamonds is becoming an important industry in the United States is strengthened by the fact that the census statistics of "lapidary work" show that the total value of production of lapidary work in 1900 was over \$5,500,000, against less than \$500,000 in 1890, and that the value of the materials used in this work in 1900 was over \$4,500,000, against less than \$250,000 in 1890.

It is indeed worthy of note that although the largest percentage of diamonds is cut outside of the United States, and all of them mined in other countries, the most improved machinery and many of the patented devices for mining and cutting have been the products of American ingenuity. Even Gardner F. Williams is an American born and bred.

Although the annual production of diamonds has increased more than 1,500 per cent in the last 30 years, and though there are produced at the present time more than 3,000,000 carats annually, as against 200,000 before the discovery in South Africa, the changed condition has come about in such a manner that the stone has not been cheapened in value, has been fixed on a more even market basis, and has that much enriched the world.

The cutting branch of the industry has almost doubled in the past eight years, and now keeps employed between 700 and 800 men. Nearly five sevenths of the diamond cutting of the

world is done in Amsterdam and Antwerp, though New York has recently begun to make its influence felt in that direction. There are about 9 or 10 cutting establishments in New York and Brooklyn, employing from 40 to 80 men each, and although the wages paid to American workmen are much higher than those paid in Europe, the advantage of better machinery in this country averages the cost of cutting. This is especially true in regard to large stones, though not always so with respect to stones running below an eighth of a carat.

Details of the artificial manufacture of diamonds in an electric furnace by Prof. Henri Moissan, at the University of Paris, were published in June 1903. His experiments were begun after his finding of microscopic diamonds in nature, in the "blue earth" from the Cape, in the sands of Brazil, and in several meteorites. His researches showed that if carbon was produced at low temperatures it was always obtained in the amorphous condition and no crystals were found. The details of the manufacture are thus described:

"For his experiment, Prof. Moissan utilized the pressure which is produced in iron when it passes from the liquid to the solid state. It is known in fact that solid iron is less dense than when in fusion, as is shown by the fact that pieces of the metal will float on the melted bath, and it thus resembles water in this respect. He melts the iron in the electric furnace and saturates it with carbon, and to carry this out 200 grammes of Swedish iron cut into cylinders half an inch long and two fifths inch diameter were placed in a carbon crucible and completely covered with powdered charcoal. The crucible was placed under the arc and heated during 3 to 6 minutes with a current of 350 amperes at 600 volts. The cover of the furnace was removed and the crucible seized with a pair of tongs and plunged quickly into a bath of cold water. The crucible and metal remain red for a few moments, giving off gases which come to the top, then the whole cools off. It was not without apprehension that the experiment was made for the first time, as it was feared that an explosion would be produced when the melted mass at 3,000 degrees came in contact with the cold water. But no bad effect is produced by the meeting of the hot mass and the liquid; and during the first period the mass is cooled rather by a rapid radiation. In order to cool it by conduction, and thus more quickly, it was placed in iron filings. In this way the diamonds which were obtained were of a peculiar nature, and they contained specks of black carbon. The pressure seems to be less, and the transformation of the carbon into the diamond is less complete. The experiment is, however, highly instructive, as it gives a form of speckled diamond which is also found in nature. To obtain a more rapid cooling, a bath of melted lead was found the best; it was kept at about the fusing point, or 617° F. The crucible, heated as before, is quickly plunged into the bath of melted lead, which is about 6 inches deep. The iron, which is lighter than the melted lead, is detached from the crucible in masses which tend to form spheres and rise more or less rapidly to the top. When the iron is saturated with carbon in the furnace, it becomes so pasty that the crucible can be turned over and it will not run out, but when it cools off the metal soon becomes liquid and gives up graphite.

## DIAMOND-JOUSTS — DIANA

"The smallest spheres, half an inch in diameter, were solid and sufficiently cool on coming to the top. These spheres gave a good yield of diamonds and the latter were especially clear and brilliant, and the spotted form was absent. Some of the crystalline forms were very sharp. One of the transparent diamonds measured as high as 0.57 millimetre, and had a somewhat triangular form with the angles rounded off. It was perfectly clear. It is curious to note that three months after its formation it split into two pieces; this fact is significant, as some diamonds from the Cape show an identical action, this being no doubt due to irregularities of pressure at the time of formation. The samples of diamonds obtained by this method were interesting to examine as to their different form. Most of them were smooth and brilliant, while others had a grained surface. All the specimens had the particular lustre which is characteristic of the native diamond. When a ray of light is sent into the interior they appear to become luminous. Some of the specimens are cubes and octahedra, with rounded angles."

**Diamond Jousts**, jousts instituted by King Arthur, "who (according to the Arthuric legend as set forth by Tennyson) by that name had named them since a diamond was the prize." Before he was king he came by accident to a glen in Lyonesse, where two brothers had met in combat. Each was slain; but one had worn a crown of diamonds which Arthur picked up, and when he became king offered the nine diamonds as the prizes at nine several jousts, "one every year, a joust for one." Lancelot had won eight and intended to present them all to the queen, "when all were won." When the knight at last laid them all at her feet, Guinevere, in a jealous rage, flung them out of the palace window into the river.

**Diamond Necklace**, a jewel the incidents connected with which have furnished materials for one of the best historical romances of Dumas. This necklace contained 500 diamonds, was valued at some \$400,000, and was made by order of Louis XV. for his mistress, Madame Du Barry. The necklace was not finished in the king's lifetime, and after his death the Du Barry was banished. Between the years 1783 and 1784 the charms of Queen Marie Antoinette had infatuated the Prince-Cardinal Rohan, who was led to believe, by the so-called Countess Jeanne de Lamotte-Valois, an unprincipled adventuress, that the queen reciprocated his feelings. The cardinal was informed that the queen was anxious to purchase the diamond necklace and wished for him to become surety for the price to the makers, MM. Boehmer and Bassaenger. The cardinal agreed to become security, the necklace was delivered, but never reached the queen. Jeanne de Lamotte and her husband, meanwhile, had disappeared from Paris, and were selling the diamonds in parcels. The plot was discovered when the jewelers went to court complaining that the necklace had not been paid for. The cardinal and others concerned were thrown into prison. As the trial established rather the folly than guilt of any one excepting the Countess Lamotte, she and her husband were branded on the shoulders as thieves, and sentenced to a life imprisonment. The resultant scandal greatly aggravated that popular rage which terminated in the French Revolution.

**Diamond-snake**, an Australian serpent (*Python spilotes*). This is a richly colored snake belonging to the true pythons. It inhabits every portion of Australia, particularly Victoria, where the rocks and watered woods afford protection. It is a nuisance to farmers, as it robs the poultry-yards. It is not venomous, but can inflict a painful bite. The markings on the scales give it its name.

**Diamond State.** See DELAWARE.

**Diamond Wedding**, the celebration of the 75th anniversary of a wedding, at which presents of diamonds are given. Other anniversary weddings sometimes celebrated are paper, wooden, tin, crystal, and china weddings, namely, on the 1st, 5th, 10th, 15th, and 20th anniversaries; while silver and golden weddings are celebrated on the 25th and 50th, respectively, presents being made to the bride of the material indicated in the title.

**Diana**, Italian goddess, whom the Romans subsequently identified with the Greek Artemis. Diana was the protectress of slaves, who held a yearly festival in her honor. She seems to have been originally the patron divinity of the Sabines and Latins. She was a virgin, and no man was allowed to enter her temple.

The Greek Diana or Artemis was the daughter of Zeus (Jupiter) and Leto or Latona, and was the twin sister of Apollo, born in the island of Delos. While yet a child she entreated her father to suffer her to continue a virgin. She desired him, at the same time, to give her a bow and arrows, a city, and rule over the hills, 60 Oceanides, and 20 river nymphs, and to permit her to bear a torch and hunt in the forests. Zeus caused 30 cities to be devoted exclusively to her worship, and appointed many others where she was venerated in common with other deities. As Apollo directs that of the sun, Artemis guides that of the moon. Eros and Aphrodite sought to conquer her in vain. Hunting, music, and dancing alone had charms for her. She punished without mercy those of her virgins who violated their vows of chastity. Actæon, grandson of Cadmus, who secretly watched her as she was bathing, she changed into a stag, and his own dogs tore him in pieces. The beautiful Endymion, however, at length made her feel the power of love. While enlightening the earth as Selene (the moon), she beheld the hunter, fatigued with the chase, slumbering in the woods. She descended from her ethereal course, and kissed the lips of the youth, who enjoyed a favor never before granted to mortal or immortal. Notwithstanding her aversion to love, she afforded aid to women who called upon her in travail. She was also the goddess of death. She aimed her darts especially at the female sex, and brought the old, who were satiated with life, to a gentle death, to make way for the vigorous and blooming. When angry she destroyed with pestilence and disease, like her brother Apollo. When offended she revenged without compassion. Thus she slew Orion, the hunter, from jealousy, because Eos (Aurora) had fallen in love with him; so also the daughters of Niobe, because their mother preferred herself above Latona, etc. In the Trojan war both Artemis and Apollo aided the Trojans; and in the war with the giants and Titans she proved her valor.

The worship of Artemis was spread through

## DIANA OF FRANCE — DIAPHRAGM

all Greece, and the various legends here related do not all refer to the same deity, it being common in ancient mythology to group together under the name of some celebrated divinity the local associations and traditions originally belonging to different mythical personages. She received many surnames, particularly from the places where her worship was established, and from the functions over which she presided. She was called Lucina, Ilithyia, or Juno Pronuba, when invoked by women in child-bed, and Trivia when worshipped in the cross-ways, where her statues were generally erected. She was supposed to be the same as the moon and Proserpine or Hecate, and from that circumstance she was called Triformis; and some of her statues represented her with three heads, that of a horse, a dog, and a boar. She was also called Agrotera, Orthia, Taurica, Delia, Cynthia, Aricia, etc. She was supposed to be the same as the Isis of the Egyptians, whose worship was introduced into Greece with that of Osiris, under the name of Apollo. The Artemisia was a festival celebrated in honor of her at Delphi. At first she was represented with a diadem, afterward with the crescent upon her head, with bow and arrows, a quiver over her shoulders, and a light hunting dress, together with her hounds. Her most famous temple was at Ephesus, and was considered one of the wonders of the world. She was worshipped there as the symbol of fruitful nature, and represented with many breasts, encircled with numerous bands.

**Diana of France**, Duchess of Montmorency and Angoulême, French intrigante: b. Piedmont 1538; d. 3 Jan. 1619. She was a natural daughter of Henry II.; was formally legitimized, and married first to a son of the Duke of Parma, next to the eldest son of the Constable de Montmorency. She enjoyed great influence at court under Henry IV., superintended the education of the young prince, afterward Louis XIII., and then retired from court.

**Diana of Poitiers**, pwā-tē-ā, Comtesse de Brézé, Duchess de Valentinois, French beauty: b. 1499; d. 1566. She was the mistress of King Henry II. of France, in whose name she ruled with unlimited power. Till his death in 1559 she exercised such an absolute empire over the king by the charms of her wit and grace, that her superstitious contemporaries ascribed her power to magic. Upon his death she retired to her castle Anet, where she established a charitable institution for the support of 12 widows. Medals are still to be seen bearing her image, trampling under foot the god of love, with the inscription, *Omniū victorem vici* (I have conquered the universal conqueror).

**Diana Monkey**, a monkey (*Cercopithecus diana*), native to the west coast of Africa. Its name is given because it bears on its forehead a crescent of upright white hairs, suggestive of the new moon, which was the emblem of the Greek goddess Diana. It is black in color, streaked with brown down the back; the fore parts are pure white, as also is the long beard. It is gentle and easily tamed, but is not strong enough to endure captivity and change of climate. Hence the specimens sent to menageries usually die within a short time.

**Diana's Tree** (*Arbor Diana*), silver tree, is formed from a solution of silver in nitric acid, precipitated by quicksilver, and crystallized in

prismatic needles which are grouped together in the form of a tree. To make this beautiful process visible, let a quantity of pure silver be dissolved in nitric acid; then dilute the saturated solution with 20 or 30 parts of water, and put in an amalgam of eight parts mercury and one part silver leaf, upon which after some days crystals are formed. The crystals consist of an amalgam of silver, or rather a definite compound of the silver and mercury. The name is formed from the supposed connection between the moon and the metal silver.

**Dian'thus**, a genus of the pink family (*Caryophyllaceæ*). The genus has about 200 species, natives of the Old World. The name is said to be from the Greek, and to signify "Jove's flower." The American species are all naturalized from Europe, and are fugitives from cultivation. The best known are maiden pink (*D. deltoides*), which in summer is found in the region from eastern Massachusetts to Michigan, and the bunch-pink or sweet-william (*D. barbatus*), found wild occasionally in the Eastern and Middle States.

**Diapason**, dī-a-pā'zōn or -sōn (meaning in Greek, complete, all-pervading), a term in music by which the ancient Greeks designated the octave. The French use the term as equivalent to pitch. Diapason is also the English name given to certain fundamental stops of the organ.

**Diapedesis**, dī-a-pe-dē'sis, a process in which red and white blood cells pass through the walls of the capillary blood vessels. It is a constant accompaniment of inflammation, and is to be regarded as a protective mechanism on the part of the body, particularly of the white blood cells.

**Diaper**, a kind of textile fabric much used for towels and napkins, and formed either of linen or cotton, or a mixture of the two, upon the surface of which a figured pattern is produced by a peculiar mode of twilling. In the fine arts the term is used for a kind of surface decoration consisting of the repetition of a simple unit or units of design evenly spaced.

**Diaper Ornament**, in architecture, an ornamentation of flowers, applied to a plain surface, either carved or painted. If carved, the flowers are entirely sunk into the work below the general surface. They are usually square, and placed close to each other, and are various in their pattern and design. Diaper work was first introduced in the early English style in some of the principal Gothic structures in England.

**Diaphoret'ics**, or **Sudorifics**, agencies that increase the secretion of sweat. The chief diaphoretics are heat—in the form of hot packs, warm drinks, etc.—alcohol, pilocarpine, opium, salicylates, and a number of the newer synthetic products, such as antipyrine, phenacetine, antifebrine, etc. Diaphoretics are employed largely to reduce temperature, as they increase the perspiration and thus permit of a large amount of surface evaporation. They are also useful agents often in the treatment of disease of the skin, since they cause an increased amount of blood to flow to the skin and thus improve its nutrition.

**Diaphragm**, dī'a-frām. 1. In anatomy, a large robust, muscular membrane or skin placed transversely in the trunk, and dividing

the chest from the belly. In its natural situation the diaphragm is convex on the upper side toward the breast, and concave on its lower side toward the belly; therefore, when its fibres swell and contract, it must become plain on each side; and consequently the cavity of the breast is enlarged to give liberty to the lungs to receive air in inspiration; and the stomach and intestines are pressed for the distribution of their contents; hence the use of this muscle is very considerable. It is the principal agent in respiration, particularly in inspiration; for when it is in action the cavity of the chest is enlarged, particularly at the sides, where the lungs are chiefly situated; and as the lungs must always be contiguous to the inside of the chest and upper side of the diaphragm, the air rushes into them in order to fill up the increased space. In expiration it is relaxed and pushed up by the pressure of the abdominal muscles upon the viscera of the abdomen; and at the same time that they press it upward they pull down the ribs, by which the cavity of the chest is diminished and the air suddenly pushed out of the lungs.

There are three openings in the diaphragm, one for the passage of the inferior vena cava; one for the passage of the œsophagus and pneumogastric nerves; and the aortic, through which pass the aorta, the right vena azygos, and thoracic duct. The diaphragm also comes into play in hiccough and sobbing, laughing and crying, sometimes causing hernia, or rupture of the viscera.

2. In optics, an annular disk in a camera or telescope or other optical instrument, to exclude some of the marginal rays of a beam of light. The original form of this beautiful contrivance is the iris of the eye, which shuts out strong light and regulates the quantity admitted.

**Diarbekir**, dē-är'/'bē-kēr', Asiatic Turkey, city, capital of the vilayet of Diarbekir. It stands on a high bank overlooking the Tigris, and is surrounded by a lofty massive wall, built of blocks of black porous stone, the best houses being also of the same material. The principal edifices are the great mosque, a fine structure with a square tower, and originally a Christian church; and the Armenian cathedral and Chaldean church, handsome buildings recently erected. The manufactures, once very extensive but now greatly decayed, consist chiefly of iron and copper ware, leather, silk, woolen, and cotton goods; the bazaars are well stocked with every description of goods, and a limited trade is carried on with Syria and Aleppo. Pop. about 40,000.

**Diarrhœa**, a symptom of a disordered condition of the intestines, accompanied by too frequent movements of the bowels, due to their increased peristaltic (or wave-like) motion. Like dyspepsia, it is only a symptom of some pathological condition. Diarrhœa is usually the result of some indiscretion in diet, such as the eating of unripe or overripe fruit, improper or indigestible foodstuffs; or of poorly cooked, decomposed, or tainted meats and fish, these inducing a kind of diarrhœa due to a toxic or poisonous bacteria known as ptomaines, and is frequently alluded to as ptomaine poisoning. While relatively more prevalent in the city than in country districts, and oftener found among

the poor than the well-to-do, it cannot be said that diarrhœa is particularly a disease of the city or of the poor, since severe and even fatal attacks of it frequently occur among the rich inhabiting the seaside or mountains.

The conditions that produce diarrhœa are varied and numerous. Exposure and sudden chilling of an overheated body, particularly of the abdomen, are potent causes; and travelers who make frequent changes of drinking water are very susceptible to it. In these cases personal idiosyncrasy plays an important role. The drinking of impure water and living in poor hygienic surroundings cause diarrhœa. Whether sewer gas or pollution of the atmosphere has direct influence is a disputed point, but it is certain that direct drainage of polluted sewage from districts infected with epidemic diarrhœa into a water supply is a potent cause.

Daily variations of temperature, such as are experienced in the hot season from May to September, are familiar predisposing factors. Environment such as is found in densely populated districts where people live in damp basements, etc., with vitiated atmosphere and want of care, is in the same category of causes.

Diarrhœa is often caused by the irritating action of mineral poisons, such as mercury, arsenic, and antimony, by overdoses of croton oil, etc., or by various cathartic nostrums. Worms of various species are likewise causative factors. Of late much attention has been given to these parasitic causes, notably that of protozoon *Amaba coli*, so frequently found in the stool of diarrhœics, principally in tropical cases. Secondary diarrhœa is a phenomenon found during an attack of some antedating disease, as ulcer of the bowel, cancerous growths of the intestines, and the inflamed and ulcerative stage of typhoid fever. In diabetes and Bright's disease it is mostly a form of eliminative diarrhœa. Nervousness, particularly in women, is an annoying cause due to a temporary local congestion of the mucous membrane of the intestine.

The symptoms of diarrhœa naturally vary with the causes, though certain symptoms are common to all forms. One of these is the frequency and character of the stools, which may vary from 5 to 20 or more in a day. At first soft, and mixed with particles of undigested food, they gradually grow more liquid until almost watery, and are attended by griping colic-like pains about the navel. Flatulence and vomiting are also prominent features, and thirst is often great, owing to loss of liquids from the body through repeated evacuations. The pulse is usually quickened, though the fever is seldom high, and is of no serious consequence. If the diarrhœa become chronic or long continued, prostration ensues, though this contingency is infrequent. Secondary diarrhœa, due to chronic congestion or pathological changes in the intestines, is much more intractable.

The treatment of diarrhœa must necessarily vary with the inciting cause, though many cases recover spontaneously or need treatment for only a few days. Absolute rest and low diet are indicated in all forms. If the attack is due to exposure or cold, the application of hot turpentine stupes to the abdomen, with the administration of small and frequent doses of opium and bismuth, may be all that is required, when, however, it is due to offending food in the intes-

tines, or to ptomaines, the prompt removal of these elements must be effected. Broken doses (one tenth gr.) of calomel every half hour, or a teaspoonful dose of Epsom salts in Vichy water, until the stools assume a more natural consistency, are prompt and efficient remedies. By far the most popular is a prepared dose of castor oil containing 10 or 15 drops of laudanum. This should be followed by astringent antiseptics, combined with opium and a digestive; for instance, sulphocarbonate of zinc or soda, opium in either powdered or extract form, with blue-mass. Should the pain be excessive, chlorodyne, or hyoscyamine, or in extreme cases small doses of morphia may be given until the patient is relieved. For the vomiting, small doses of hot water, or plain lime water will be effective, and the application of the old-time spice-plaster or hot poultice will be found soothing. Some prefer the ice-bag. Should there be any oppression, aromatic spirits of ammonia, or stimulants like brandy or whiskey, well diluted, will restore the strength, though this is seldom necessary.

The undue haste to stop diarrhoea suddenly, and the eagerness which patients exhibit to take large doses of paregoric or laudanum, or nostrums called cholera drops or diarrhoea mixtures, in all cases is mentioned only to be condemned. A more rational course is to remove the cause, thereby assisting nature to regain her normal tone and re-assert her disturbed functions.

In children and infants the same general rules should be followed, with modifications to suit each individual. In place of milk, substitute a milder form of nourishment such as egg, barley, or rice water. (See CHOLERA INFANTUM.) Another and more direct form of treatment than giving remedies by the mouth is the use of enemas, or both can be employed in conjunction. High rectal enemas are used of astringent antiseptics held in suspension in thin starch solutions, or with turpentine added.

The constipation which usually occurs after recovery from diarrhoea had better be disregarded for a day or two, when mild cathartics or laxative remedies can be used. Very effective remedies are glycerine suppositories and enemas of cold water.

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**Diary**, a daily record of events or observations made by an individual. It contains a narrative, more or less detailed, of matters of personal interest, often including the results of reading or meditation. Yet references to current events of general interest are sometimes introduced. This form of diary is also known as a journal. To the mercantile man a diary serves the purpose of an order or memorandum book; while the physician finds it indispensable as a register of engagements. Books convenient for making such records are issued every year, containing besides the blank pages, various reference tables, etc. The "Ephemeris" of the ancients was originally a military record or journal, a day-book or account-book, also a collection of tables showing the position of the heavenly bodies, but passed into literature to mean a collection of records of what has happened on the same day in various years, or a mere general name for any form of periodical books or magazines.

Diaries have often furnished the historian with invaluable material, supplying the absence of public records, and furnishing minute and intimate details of manners and of motives that do far more to help us to understand the past than more formal records. Such documents as Robert Baillie's 'Journals,' the 'Diaries' of Pepys and Evelyn, and the 'Journals' of Greville are among the most valuable sources of real history.

**Dias, Antonio Gonçalves**, ăn-tô'nê-ô gôn-săl'vêth dê'ăs, Brazilian poet: b. Caxias 10 Aug. 1823; d. 3 Nov. 1864. He was educated in Portugal, and returning to his native country, published at Rio de Janeiro in 1846 a volume of poems entitled 'Primeiros cantos,' which was followed by his drama of 'Leonor de Mendonça' (1847); 'Segundos cantos' (1848); and 'Ultimos cantos' (1850). In 1848 he was chosen professor of national history in the college of Dom Pedro II.; he was subsequently employed in the office of the minister of foreign affairs, and in 1855 was charged with a scientific mission to Europe. His poetry has been exceedingly popular in Brazil.

**Dias, Bartholomeu**, bār-tô-lôm-mă'ôo, Portuguese navigator: b. about 1445; d. 29 May 1500, while on his way from Brazil to India. In 1486 he sailed on an expedition to explore the west coast of Africa, and without knowing it was carried around the southern point of the continent and landed at the mouth of Great Fish River, where he discovered that he was on the east coast. The stormy cape he called Cabo Tormentoso, a name which the king of Portugal changed into Cape of Good Hope. Dias subsequently sailed on another African expedition under Vasco da Gama, and commanded one of the vessels in the fleet with which Cabral discovered Brazil. It was on this expedition that he perished.

**Dias, Henrique**, ăn-rêk', Brazilian general: b. Pernambuco about 1600; d. latter part of the 17th century. He was a freed negro, who by his superior attainments rose in 1639 to the supreme command of the colored soldiery of the Brazilian army. He took a conspicuous part in the protracted warfare which finally led to the overthrow of Dutch influence.

**Diaspore** (Gr. "scattering"), a native hydrated oxide of aluminum, having the formula  $Al_2O_3 \cdot H_2O$ , and crystallizing in the orthorhombic system. It is commonly gray, creamy-white, or lilac in color, though sometimes various shades of brown and yellow, or colorless. It has a hardness of from 6.5 to 7, and a specific gravity of about 3.4. It is transparent to sub-translucent, and exhibits powerful doubly refracting properties. The best known localities in which it occurs are Chester, Mass., Newlin, Pa., in the United States, and in Europe near Schemnitz, Hungary. Many specimens decrepitate strongly when heated before the blowpipe, separating into pearly scales that are scattered in all directions; and it is from this peculiarity that the mineral derives its name.

**Diastase**, dī'a-stās, a substance existing in barley, oats, and other plants, and also in animals. When in solution it possesses the property of causing fecula or starch to break up at the temperature of 156° F., transforming it first



into dextrine and then into sugar. It is obtained by digesting in a mixture of three parts of water and one of alcohol, at a temperature of 113° F., a certain quantity of germinated barley ground and dried in the open air, and then putting the whole under pressure and filtering it. It is solid, white, and soluble in water and diluted alcohol, but insoluble in strong alcohol. If 200 parts of fecula be mixed with 1,000 parts of water, and a portion of diastase be added, and the mixture kept at a temperature of about 156° F., the starch is converted gradually into dextrin and grape-sugar. The action of diastase is prevented by acids, alkalis, and some salts, but not by alcohol or ether. A solution of diastase becomes acid, and loses its power on starch. The action of the diastase of germinating barley is important in brewing. The composition of diastase has not been exactly determined. It is, however, an albuminoid substance. A body having the power of converting starch into sugar exists in saliva and is known as ptyalin. It is also an albuminoid, and is probably analogous to diastase in its composition. Diastase is used in the manufacture of dextrin (q.v.), and it has also been proposed for dissolving the starch and dextrin used by printers for thickening their colors.

**Diastole**, dī-ās'tō-lē. In the description of circulation of the blood it was shown that Harvey first appreciated that there was a successive contraction and dilatation of the heart-muscle. The term systole has been applied to this contracted state and the term diastole to the succeeding dilatation.

**Diathermancy**, a term designating the property that is possessed in various degrees by different substances of transmitting radiant heat. Bodies that are equally transparent, that is, bodies which have equal power of transmitting rays of light, are very different in their power of transmitting heat rays. Thus a thin plate of glass and a thin plate of rock salt may be nearly equally transparent, but the plate of rock salt has far superior power of transmitting rays of heat. This may be shown very simply. Let a delicate thermometer be placed near to a lamp (but not above it), the mercury will rise on account of the heat radiated to it. If a plate of rock-salt be interposed between the lamp and thermometer, the mercury will fall slightly; but if a plate of glass of equal thickness with the plate of rock-salt be interposed, it will be seen that the greater part of the heat is at once cut off from the thermometer. The transparency of bodies to light does not at all necessitate their diathermancy. Thus clear rock-crystal, which is transparent, and smoky rock-crystal, which is opaque, are nearly equally diathermanous; and solution of iodine in bisulphide of carbon, which is perfectly opaque to light, is highly diathermanous. The diathermancy of plates of various thickness has also been determined. The diathermancy decreases very rapidly as the thickness increases. Consult: Stewart, 'Treatise on Heat'; Deschanel, 'Elementary Treatise on Natural Philosophy.' See also RADIATION; THERMO-ELECTRICITY.

**Diathesis**, dī-āth'ē sīs. There is in all organic life a certain predisposition for the constituents of the cells to behave in a certain predetermined manner, and in medicine this term

comes to mean the predisposition or constitution of a body by virtue of which certain of its tissues or organs become at one time or another the seat of affections similar in their nature. Thus there exists in certain families a tendency to the development of certain constitutional diseases, such as gout, rheumatism, tuberculosis, etc. In others there may be a predisposition to nervous instability. In others there are conditions which bring about ready disturbance of the digestive powers. In most of these instances there seems to be a point when the store of vitality in the tissues of an organ becomes exhausted earlier than in other predisposed individuals, so that diathesis may be described in other words as a premature localized breakdown.

**Diatomaceæ**. See DIATOMS.

**Diatoms**, dī'a-tōmz, a sub-order of microscopic plants belonging to the class *Algæ*. A plant of this sub-order consists of a unilocular or a septate cell; and its cells are composed of two symmetrical valves, multiplying by spontaneous separation. There are two well-defined sections: (1) *Diatomeæ*, including species invested with a silicious epidermal covering, occurring both in fresh and salt water, often exhibiting exquisite sculpturings when seen under the microscope, and testing the highest powers of the instrument; (2) *Desmidiæ*, minute fresh-water plants of a green color, without a silicious covering. There are more than 4,000 distinct species scattered over all parts of the world. The walls of the cells are rendered hard by silica and they are reproduced by fission, the splitting taking place parallel to the longer axis. When the protoplasm escapes the cell walls retain their shapes and delicate markings. Enormous quantities of them are found as fossils in the beds of the Tertiary formation. Often the protoplasm of two diatoms will escape and unite to form a zygospore, which after a time will divide into two, each forming a new cell larger than before. Some diatoms are free and move rapidly through the water; others secrete a mucilaginous substance whereby they attach themselves to various objects. In some cases the diatoms, after splitting, remain attached to one another, forming bands or ribbons. They are classified, according to the structure of the cell walls, three main families being recognized, according as they have on the principal face of the wall a distinct ridge (*Raphidiæ*), an indistinct or false ridge (*Pseudoraphidiæ*), or no ridge at all (*Araphidiæ* or *Cryptoraphidiæ*).

The diatoms possessing a silicious epidermis have been eagerly studied of late years by microscopical observers, who have greatly increased the number of genera and species. They are universally distributed, and their silicious coverings being indestructible, their remains are accumulated and perpetuated in many localities, sometimes forming extensive deposits, as of Richmond, Va., which is said to be built upon a stratum of these microscopically minute atoms 18 feet in thickness. Species of *Arachnoidiscus* and other genera of great beauty are obtained from guano. The bergmehl or mountain-meal of Sweden consists of diatoms. The mud at the mouths of many rivers, the sediment of ponds, ditches, and even rain-troughs, contain myriads of the same minute organisms. They were found by the Arctic navigators investing the



## DIATONIC — DIAZ DEL CASTILLO

fields of polar ice; and they have also been detected in the dust evolved from volcanoes.

**Diaton'ic**, a term used in the science of music, originally from the Greek, meaning "through the tones." The diatonic mode of the ancient Greeks—as distinguished from their chromatic and enharmonic mode—formed the foundation of their whole system of music, and was arranged in three tetra chords composed of one semitone and two whole notes. In modern music the term is applied to compositions which follow the tones, intervals, or harmonies of the standard major or minor scales, without chromatic alteration.

**Diatrībe**, *dī'a-trīb* (Greek, *diatribé*), a dwelling or lingering upon, originally signified a sustained discourse or disputation, afterward came to be applied to a violent and sweeping criticism, whether written or spoken.

**Diaz, dī'áz**, Abby Morton, American writer: b. Plymouth, Mass., 1821; d. Belmont, Mass., 1 April 1904. She was a member of the famous Brook Farm Association, and has been an earnest worker in social reforms. She founded the Woman's Educational and Industrial Union of Boston, and was its president for many years. Her books for children include: 'The Cat's Arabian Nights' (1881); 'The John Spicer Lectures' (1887); 'Polly Cologne'; 'Jimmyjohns'; and 'The William Henry Letters' (1870). Other works are: 'Bybury to Beacon Street, a Discussion of Social Topics'; 'Domestic Problems'; 'Only a Flock of Women' (1893).

**Diaz, Miguel**, *mē-gēl' dē āth*, Spanish explorer: b. Aragon second half of the 15th century; d. 1514. He took part in the second voyage of Columbus, and was one of the colonists of the island of St. Domingo. He quitted the colony in 1495 in consequence of a duel, and took refuge with a few of his companions in the southern part of the island, where he married a native. Through the advice of his wife he discovered the gold mines in this part of the island, the existence of which he communicated to Bartolomé Columbus, whereby he reconciled himself with the colonists, and led the way to the foundation of the town of Nueva Isabella, afterward called St. Domingo. He was made governor of Porto Rico in 1509, but his fidelity to the family of Columbus repeatedly brought him into trouble.

**Diaz, Porfirio**, *pōr-fē'rē-ō dē'ās* or *dē'āth*, Mexican statesman: b. Oaxaca 15 Sept. 1830. He received a classical education at the Oaxaca Institute, and had begun studying law when the war with the United States broke out. He served through that struggle in the National Guard, and on the conclusion of peace made a study of military science. On Santa Anna's accession to the dictatorship, he left the army and practised law; but returned and bore a conspicuous part in the revolution of 1854; took the field to oppose the French troops and was taken prisoner, but made his escape; harassed Maximilian's troops till forced to surrender a second time at Oaxaca in 1865; besieged and captured Puebla in 1867, and immediately marched on Mexico City, which surrendered to him 21 June. On the re-establishment of the republic he was an unsuccessful candidate for president. In 1872 and 1876 he led revolutions

against the government, and after three severe battles occupied the capital in the latter year. In 1877 he was elected president to fill the unexpired term of the fugitive president, Lerdo. According to the "plan of Tuxtepec," which he had proclaimed, he was ineligible to succeed himself. His secretary, Gen. Gonzales, was elected president, and Gen. Diaz was appointed chief-justice of the supreme court, and elected governor of Oaxaca. In 1884 he was re-elected president; in 1886 his partisans secured the abolition of the law prohibiting a second consecutive presidential term, and he has been thereafter continuously re-elected, his sixth term expiring 30 Nov. 1904. To Diaz Mexico is indebted for her rise, progress and standing as a nation. He has made property secure by preserving a stable government, and deserves the confidence of his people.

**Diaz, Ruy**, *roo'ē dē'āth*, Spanish soldier: b. Seville, Spain, 1503; d. Peru 1538. He went to Peru in 1532 with the expedition of Diego de Almagro, and took part in the conquest of Cuzco; then joined Velalcazar in the conquest of the province of Quito. He was sent by Pizarro to explore the valley of the Rimac, and it was in accordance with his report that the site was chosen for the city of Los Reyes (now Lima), and the city founded. When war broke out between Almagro and Pizarro, Diaz sustained Almagro, was in the battle of Abancay 1537, and other important engagements, and was captured at the battle of Salinas 1538, and put to death.

**Diaz del Castillo, Bernardo** (vulgarly **Bernal**), one of the Spanish conquerors of Mexico, and historian of that conquest: b. Medina del Campo, in Old Castile, about 1498; d. Santiago de los Caballeros, Guatemala, leaving numerous descendants. His work, entitled 'Historia Verdadera de la Conquista de la Nueva España,' is of uncommon value and interest. Date of his death not known. Probably his family belonged to the minor nobility: he says, when speaking of the conquerors, "We were for the most part hidalgos, although some were not of such clear lineage as others"; but he lacked the influence necessary to secure his appointment as an officer. He speaks of himself as "having been in this country (Central America and Mexico) twice before the coming of Cortés, and the third time with him." On the first occasion he accompanied Pedrarias Davila (q.v.); on the second, he took part in the expeditions to Yucatan and along the coast of Mexico under Córdoba and Grijalva (1517-18). Between 1515 and 1517 he visited Cuba; from Santiago de Cuba, on 18 Nov. 1518, he sailed with the Spanish fleet under Cortés; during the next few years he fought, it is said, in more than 100 of the battles with the Indians preceding or following the capture of the City of Mexico; and in 1523-4 he served under Pedro de Alvarado, conqueror of Guatemala and Salvador. Alvarado established the seat of government in the native (Guatemalan) town of Almolonga, afterward called Santiago de los Caballeros; and Bernal Diaz was made governor of this town, as a reward for his service in the field. He writes naively: "I was held in no inconsiderable degree of estimation in my day as a soldier"; and again, "I was twice in the hands of the enemy who were carrying me off to sacrifice, but God gave me strength to



GENERAL PORFIRIO DIAZ,  
President of Mexico.



escape out of their clutches." In 1550 he was summoned to an important council at Valladolid, "as being the most ancient of the conquerors of New Spain." His history was finished 26 Feb. 1568. Two licentiates who examined the work at that time, "observed that in regard to my style or language it was conformable to that in ordinary use in Old Castile, and that as such it was the more agreeable, not being embarrassed with flowering, affected phrases." The particular merit of the history is that it gives to each of the officers and soldiers the credit which was his due, instead of ascribing the overthrow of the Aztec empire and the establishment of New Spain solely to the genius of Cortés. "The historians Gomara and Illescas," Diaz writes, "never chose to relate our heroic actions, leaving all our value and honors in the dark, where they would have remained were it not for this my true history, and assigning such great merit to Cortés. Although they were right to a certain degree (in praising our leader), yet they should not have forgotten us." So desirous is he to make known the exact truth, that at the end of his manuscript he writes, "I beg the printers (señores impresores) for mercy's sake not to omit anything from or add anything to the foregoing."

MARRION WILCOX.

**Diaz de Escobar, Narciso**, nār-thē'sō dē āth dā ēs'kō-bār, Spanish poet: b. Malaga 25 June 1860. He won great popularity with his lyric poems, and several of his dramatic compositions have been very successful. 'A Morisco Episode'; 'The Young Men of the Day'; 'Two Husbands and a Wife.' In collaboration with other writers he has published a volume of 'Character Sketches from Madrid.'

**Diaz de la Peña, dē'āth dā lā pē'ñā**, Narcisse Virgile, French painter b. Bordeaux 20 Aug. 1807; d. Mentone, France, 18 Nov. 1876. He was of Spanish parentage, and at the age of 15 was apprenticed to a porcelain painter, but ambitious of working in oils about 1831 began to exhibit in the Salon. He in time won fame by his landscapes, which he peopled with nymphs, loves, and satyrs. These figures are badly drawn, but as a colorist Diaz ranks highly among the painters of the romantic school in France, and to color he was content frankly to sacrifice form. He was also an exquisite painter of flower-pieces.

**Diaz de Pineda, Gonzalo**, gōn-thā'lō dē-āth dā pē-ñā'dā, Spanish soldier: b. Torrelavega about 1500; d. Peru 1545. He went to Peru with Francisco Pizarro in 1531; explored the river Magdalena in 1535; and in 1539 became governor of the province of Quito. In 1540 he joined the expedition of Gonzalo Pizarro for the conquest of the Canelos and the exploration of the country east of the Andes. He was sent in search of the party of Orellana, who had gone ahead to seek for supplies. In the course of the search, which was unsuccessful, Diaz explored a large part of the course of the Amazon, but returned to the main expedition, which by his aid succeeded in returning to Peru, though with heavy losses. When Gonzalo Pizarro revolted against the viceroy, Nuñez, Diaz at first offered his services to the viceroy, but later joined Pizarro. He was surprised and defeated by Nuñez, but escaped capture.

**Diaz de Solis, Juan.** See SOLIS, JUAN DIAZ DE.

**Dib'din, Charles**, English lyric and dramatic poet and actor: b. Southampton March 1745; d. London 25 July 1814. He opened a little playhouse in London, the Sans Souci Theatre, and there brought out his own plays, enlivened with his own songs, set to music of his own composition, and with himself as the leading actor. He wrote probably 50 plays and operettas (best remembered among them 'The Quaker,' an operetta), two novels, a 'History of the Stage,' and over a thousand songs. His 'Sea Songs,' such as 'Tom Bowling,' and 'The Flowing Can,' are popular favorites still. He wrote an autobiography: 'Professional Life' (1803).

**Dibdin, John Thomas**, English song writer and dramatist: b. London 21 March 1771; d. there 16 Sept. 1841. He was the second son of Charles Dibdin (q.v.), and in 1775, when only in his fourth year, was brought upon the stage as the Cupid of Shakespeare's 'Jubilee,' while Mrs. Siddons personated Venus. After being connected with various theatres, and writing great numbers of songs, he returned to London in 1795, wrote a number of dramas with great success for the minor theatres, and obtained an engagement at Covent Garden, with which he continued connected for 14 years. Among his numerous pieces the best known are: 'Mother Goose,' by which the theatres are said to have netted a profit of \$100,000; the 'High-mettled Racer,' which was almost equally profitable; 'The Cabinet'; 'The Jew and the Doctor'; and 'Past 10 O'clock,' which long held the stage. He wrote a 'Metrical History of England' (1813); and 'Reminiscences' (1827).

**Dibdin, Thomas Frogmal**, English bibliographer, son of the elder brother of Charles Dibdin (q.v.), the celebrated naval song writer: b. Calcutta 1776; d. Kensington 18 Nov. 1847. He became a popular preacher in London, and was well known there as a bibliomaniac. He proposed a club to dine together in honor of bibliography, which was established in 1812, under the name of the Roxburgh Club. This club adopted a rule that each member should every year reprint a book for presentation to all the members. Of his numerous writings those connected with bibliography are alone of any value. Among them may be noted: 'Bibliomania' (1809); 'Bibliographical Decameron' (1817); 'Typographical Antiquities of Great Britain' (1810-19).

**Dibranchiata, dī-brān-kī-ā'tā**, an order of cephalopods (see CEPHALOPODA), characterized by the possession of two gills only, and by the fact that the shell, if external, as is rarely the case, is never chambered. It includes the cuttlefishes, squids, and paper nautilus, as well as the extinct family of *Belemnitidae*. The order contains two sections, *Octopoda* and *Decapoda*.

**Dibutades, dī-bū'ta-dēz**, Greek sculptor or potter of Sicyon: lived about 600 B.C. Although he is the reputed originator of work in relief, the only historical basis for his fame is a Corinthian work, bearing his name, supposed to date from before 600 B.C.

## DICE—DICHROIC CRYSTALS

**Dice** (plural of *Die*), small cubes of bone, or ivory, on each of the six sides of which a number, ranging from one to six, is marked permanently. The sum of the two numbers on the opposite sides of a die is always seven; thus if six is at the top one is at the bottom, and so on. One, two, three, or five dice are used, according to the game to be played. It, or they, are placed in a cylindrical box about four inches high, and from one and a half to two inches in diameter, open at the top. The box is shaken and turned quickly up so that the dice will fall flat on the table. The aggregate amount of the spots uppermost at each throw are summed up and placed to the score of the thrower. The purposes to which the throwing of dice is put are endless, besides the many games in which they are used in a variety of ways. The principal games are "throwing the dice," "round the spot," "centennial," "multiplication," "going to Boston," "draw poker," and "vingt-un," all of which will be found described in detail with the rules of each game in A. Howard Cady's 'Dice' (1895).

There is no period of history, and no nation, in which some form of dice has not been used. They are depicted on the early Egyptian monuments; those excavated at Thebes can scarcely be distinguished from the dice made to-day, and their use is attested by laws regulating the games played with them in ancient Greece and Rome, as well as in most European countries.

The invention of dice is attributed to Palamedes (circa 1,244 B.C.). But the use of cubes with numbered sides for gambling purposes is probably much earlier.

The Latin word for dice, *tessera*, is derived from the Greek *tesseres*, Ionic for *tessares*, four, because it is on every side square. Numerous passages in the ancient writers, and very many representations in marble or paintings, show how frequent dice-playing was among them. Different from the *tessera*, which were precisely like our dice, were the *tali* (which means, originally, the pastern bone of an animal—Greek, *astragalos*). These were almost of a cubic form, and had numbers only on four sides, lengthwise. Three *tessera* and four *tali* were often used together, and the game with dice was properly called *alea*, though *alea* afterward came to signify any game at hazard, and *aleator* a gambler.

**Dicentra**, di-sen'tra, a genus of plants of the poppy family (*Papaveraceæ*), now generally known as *Bicuculla*, original spelling *Bikukulla*, Greek for double-hooded. The genus numbers about 15 species, natives of North America and western Asia. The best-known American species are the Dutchman's Breeches (*B. cucullaria*), and bleeding-heart (*B. eximia*). The common squirrel-corn (*B. canadensis*), is also a member of the genus. The Dutchman's Breeches grows in woods from Nova Scotia to Lake Huron, Mich., and Washington, south to North Carolina and Missouri. Bleeding-heart is found in rocky places from the western part of New York, south to Georgia and Tennessee, along the mountain ranges.

**Diceratherium**, an extinct genus of rhinoceroses which inhabited North America during the Oligocene Epoch, distinguished by a pair of horns one above each eye, instead of on the middle line of the head.

**Dicey**, Edward, English journalist and author: b. Leicestershire, England, 1832. He was graduated at Trinity College, Cambridge, and was from 1870 to 1889 editor of the 'Observer.' He has published: 'Rome in 1860' (1861); 'Cavour: a Memoir' (1861); 'Six Months in the Federal States' (1863); 'The Schleswig-Holstein War' (1864); 'The Battle-fields of 1866' (1866); 'A Month in Russia During the Marriage of the Czarewicz' (1867); 'The Morning Land' (1870); 'Victor Emmanuel' (1882); 'England and Egypt' (1884); 'Bulgaria, the Peasant State' (1895); 'The Story of the Khedivate' (1902).

**Dichotomous** (Gr. "divided into two equal parts"), a term specifically used in botanical description to designate any appearance of branching by forking. Thus the stems of some phanerogams—for example, mistletoe, doum-palm, and many inflorescences—for example, *Caryophyllæa*, begonias—appear forked, while an ordinary fern-frond has no such appearance. The progress of morphological research has, however, shown that true dichotomy—for example, complete division of the growing point into two lateral apices, is really as characteristic of development of the fern-frond as of such obviously dichotomous vegetation as that of *Selaginella*; while conversely the appearance of forking in phanerogams comes about simply by the suppression of the growing point, and the development of two new axes from opposite lateral buds. Outside the cryptogams, indeed, no case of true dichotomy has been described, with the doubtful exception of the roots of cycads. See CRYPTOGRAMIA; CYCADS; FERNS.

**Dichotomy** in logic, a distribution or separation of ideas by pairs; the division of a class into two sub-classes opposed to each other by contradiction, binary classification as revived by Ramus against the Aristotelians; the Platonic doctrine that all classification should be by dichotomy. Since Kant this opinion has found scant favor.

In botany, a term applied to that kind of branching by a constant furcation or division into two parts, as where the stem of a plant branches into two branchlets, each of which in its turn divides into others, and so on. Example, the mistletoe. The veins of various ferns thus branch dichotomously.

In astronomy, that phase of the moon where it appears bisected or is only half illuminated, as at the quadratures.

**Dichroic Crystals**, so called from their property of exhibiting two colors when polarized light is passed through them in different directions. Thus dichroite, a mineral described below, appears deep-blue in the direction of the principal axis, and yellowish-brown in a direction at right angles to it, even when viewed with ordinary light. Brewster gives a list in his 'Optics' of over 30 crystals which exhibit this property with the aid of a polariscope. The name trichroic is applied to crystals which exhibit three colors when viewed in three directions.

**Dichroic Crystals**, those which exhibit dichroism (q.v.).

**Dichroism** (Greek, *dis*, "twice," *chroa*, "color"), the property which many colored doubly refracting crystals have of exhibiting

different colors in different directions. Thus the color of a green tourmaline appears very much darker in the direction of the vertical axis than when the crystal is viewed at right angles to that axis. As in many instances three colors are exhibited, the term "pleochroism" (Greek *pleon*, "more"; *chroa*, "color"), being of a more general character, is often used. A crystal of iolite (dichroite) appears blue in the direction of the vertical axis, yellowish-white in the direction of the macro-axis and bluish white in the direction of the brachy-axis. Dichroism is best detected by the instrument known as the dichroscope. This consists of a rhomb of Iceland spar with wedges of glass cemented at each end of it. These are enclosed in a metal cylinder with a lens at one end and a square opening at the other. If a section of a dichroic crystal is placed in front of the orifice and is viewed through the instrument, two colored squares are seen side by side, one corresponding to the ordinary ray, the other to the extraordinary ray. Dichroism may also be observed by means of the polarizing microscope, by removing one of the nicols and revolving the stage. This furnishes a method of determining in rock sections biotite, tourmaline, epidote and hornblende, all of which are dichroic. Thus hornblende is easily distinguished from augite, which is not dichroic. Optically uniaxial crystals, or those belonging to the tetragonal and hexagonal systems, are dichroic; optically biaxial crystals, or those belonging to the orthorhombic, monoclinic and triclinic systems, are trichroic. Isotropic bodies, including isometric crystals and also amorphous substances such as opal and glass, transmit the same color in any direction. Dichroism, or the allied term "Dichromatism," has also been applied to those fluids which appear of different colors when viewed by reflected and refracted light; when seen in thick or thin layers, etc. For example, venous blood, or any blood impregnated with carbonic acid, hydrogen, or nitrogen, appears, when seen in moderately thin layers, to be of a purple color; while in extremely thin layers it appears green. This property of marked color-variation is due to the difference in the absorption of the light-vibrations in different directions. The property of dichroism is a great aid to the jeweler in distinguishing gems. Diamonds, spinels and garnets show no dichroism; sapphire, ruby, emerald, beryl, tourmaline, topaz and chrysoberyl all have characteristic dichroism.

**Dick, James**, Scottish merchant: b. Forbes, Morayshire, November 1743; d. 24 May 1828. He left over \$565,000 to promote higher learning among the parish schoolmasters of the shires of Elgin, Banff, and Aberdeen. The annual value of the bequest exceeds \$20,000, allowing a payment of about \$150 to each teacher participating.

**Dickcissel**, dīk-sīs'sēl, or **Black-throated Bunting** (*Spiza americana*), a species of finch in which the male is easily distinguished by a conspicuous jet-black throat-patch on a light yellowish background; the upper parts in both sexes are grayish brown variously streaked above with both lighter and darker shades. During the nesting season the black-throated bunting inhabits cultivated fields of the eastern United States, especially southerly. It winters in South America. The song is a very simple

unmusical ditty, and the nest is built on or very near to the ground.

**Dickens, Charles**, English novelist: b. Landport, Portsmouth, 7 Feb. 1812; d. Gadshill, near Rochester, England, 9 June 1870. His earliest years were passed chiefly at Chatham and in London, where his father, a very careless and improvident man, spent some time along with his household in a debtors' prison. Charles about this period, and while still a mere boy, was a drudge in a blacking warehouse. He got but little education, but about 1826 became an attorney's clerk, and while in this position studied shorthand and other subjects, and finally was able to exchange his occupation for that of a newspaper reporter and critic. In 1835 he was engaged on the *Morning Chronicle*, then one of the leading daily papers of the metropolis. On 9 June 1835 appeared the first of the series of 'Sketches of Life and Character by Boz,' which were published in the evening edition of that paper, under the title of 'Thoughts About People, by Boz.'

The 'Sketches by Boz, Illustrative of Everyday Life and Every-day People' were published in 1836, with illustrations by George Cruikshank. From this publication may be dated the origin of Dickens' fame. Chapman and Hall engaged him to prepare the letterpress for a series of comic sketches on sporting subjects, the outcome of which was the immortal 'Pickwick Papers' (1837). Great characteristics of Dickens' genius were now fully apparent, and his fame rose at once to the highest point.

The next important literary engagement of Dickens was with Bentley's 'Magazine,' which he edited for two and a half years under the pseudonym of Boz. In these volumes appeared 'Oliver Twist' (1839). Before the completion of 'Oliver Twist,' 'Nicholas Nickleby' was begun, and like Pickwick was published in monthly shilling parts. It was issued complete in 1839. Accompanying it, besides the usual illustrations, is a portrait by Maclise, in which the author is represented as "a somewhat dandified young man in a high velvet-collared coat."

'Master Humphrey's Clock,' issued in weekly numbers, contained among other matter two other leading tales, 'The Old Curiosity Shop,' and 'Barnaby Rudge,' the latter a historical tale, going back to the time of the Gordon riots. Both were published separately in 1841. The same year he visited America for the first time. Here many aspects of society struck him in a curious light, and on his return he wrote 'American Notes for General Circulation' (1842). His next novel, 'Martin Chuzzlewit' (1844), dwelt again on his American experiences.

The series of 'Christmas Tales' excited a new sensation of wonder and delight. These tales were: 'A Christmas Carol' (1843); 'The Chimes' (1844); 'The Cricket on the Hearth' (1845); 'The Battle of Life' (1846); 'The Haunted Man and the Ghost's Bargain' (1847). In 1845 Dickens went to Italy, and paid a visit to Rome, and on 1 Jan. 1846 in the first number of the *Daily News* appeared the first chapter of his 'Pictures from Italy.' Immediately after this followed 'Dealings with the Firm of Dombey and Son, Wholesale, Retail, and for Exportation' (1848); and 'David Copperfield' (1849-50). In 1850 Dickens commenced to edit the weekly serial, 'Household Words,' in



which various original contributions from his own pen appeared. Later works were: 'Bleak House'; 'A Child's History of England' (1852-4); 'Hard Times' (1854); and 'Little Dorrit,' commenced in 1857. In 1859 'All the Year Round' superseded 'Household Words'; and in the first number of this periodical, 28 May, was begun 'A Tale of Two Cities.' 'Great Expectations' followed in the same paper (1860). In 'All the Year Round' also appeared a series of disconnected sketches, called 'The Uncommercial Traveller' (1868). 'Our Mutual Friend' (1865) was the last great serial work which Dickens lived to finish.

The first number of Dickens' last work, 'The Mystery of Edwin Drood,' was issued on 1 April 1870, and only three numbers had appeared at the time of his death. Three other numbers were published from the MSS. he had left, but the story remained unfinished.

Dickens married in 1838 the daughter of George Hogarth, a musical writer and critic. In the same year he openly avowed the authorship of *Pickwick*. He had a decided taste for theatricals, and was a successful amateur performer. He frequently turned his talent in this way, and as a public speaker, to charitable purposes. He was also an admirable reader, and during the last 15 years of his life made frequent reading tours in which he gave semi-dramatic readings from his own works to appreciative audiences. He visited the United States a second time in 1867-8 on a reading tour. The enthusiastic reception he met with caused him somewhat to modify the severe opinions he had expressed in his 'American Notes,' and a sort of apologetic note was prefixed to the next edition of them, with the desire expressed that it should accompany all future editions. He was buried in Westminster Abbey. See Forster, 'Life of Dickens' (1872-4); Fitzgerald, 'The History of *Pickwick*' (1891); Kitton, 'The Novels of Charles Dickens' (1897); and 'The Minor Writings of Charles Dickens' (1900); Gissing, 'Charles Dickens: a Critical Study' (1898). In 1880-2 his eldest daughter edited his letters.

**Dickens, Charles**, English editor: b. 1837; d. Kensington, England, 20 July 1896. He was the eldest son of the preceding; was educated at King's College, Eton, and at Leipzig; became assistant to his father as editor of 'All the Year Round,' and subsequently chief partner in a printing firm. He edited a 'Life of Charles Mathews'; 'The Dictionary of London'; 'Paris and the Thames'; and a complete edition of his father's works.

**Dickens, Mary Angela Evans**, English novelist: b. 1838. In 1861 she married the eldest son of Charles Dickens. Her best-known novel is 'A Mere Cipher' (1893). She has also written: 'Cross Currents' (1892); 'Valiant Ignorance' (1894); 'Some Women's Ways,' a volume of short stories; 'Prisoners of Silence' (1895); 'Against the Tide' (1897); 'On the Edge of a Precipice' (1899); 'The Wastrel' (1901).

**Dick'erman, Lysander**, American Egyptologist: b. Bridgewater, Mass., 1830; d. Boston, Mass., 13 Dec. 1902. He was educated at Brown University and Andover Theological Seminary, and entered the Congregational ministry in 1858. He held various pastorates in

New England, Illinois, and California, and in his later years devoted much attention to Egyptology, publishing: 'The Egyptian Deities' (1885); 'The Hittites of the Bible' (1889); 'The Fayam' (1892); 'Mariette Bey's Monument of Upper Egypt' (1900).

**Dickey, Charles Andrews**, American Presbyterian clergyman: b. Wheeling, W. Va., 25 Dec. 1838. He was educated at Washington College, Pennsylvania; studied at the United Presbyterian Theological Seminary 1858-61; and was pastor of the United Presbyterian Church, Allegheny City, Pa., 1861-9; the First Presbyterian Church, St. Louis, 1869-75; Calvary Presbyterian Church, Philadelphia, 1875-93; and has been pastor of the Bethany Presbyterian Church, Philadelphia, from 1893. He was moderator of the Presbyterian General Assembly 1900-1, and during his pastorate in Philadelphia was prominently associated with all the benevolent operations of his Church.

**Dickie, George William**, American engineer: b. Arbroath, Scotland, 17 July 1844. He studied engineering in his father's shipyard, and with the North British Railway Company, and came to the United States in 1869. He was engaged in steamship work on the Pacific coast, designed machinery for the Comstock mines, became president of the Union Iron Works in 1883, giving especial attention to naval work. He has written: 'Pumping and Hoisting Works' (1876).

**Dickins, John**, American Methodist clergyman: b. London, England, 24 Aug. 1747; d. Philadelphia, Pa., 27 Sept. 1798. He was educated at Eton and emigrated to America prior to the American Revolution. Becoming a Methodist in 1774, he entered the ministry, becoming one of the most notable preachers of his day. He was instrumental in founding Cokesbury College, Maryland, and the Methodist Book Concern.

**Dickinson, Anna Elizabeth**, American orator, novelist, and playwright: b. Philadelphia 28 Oct. 1842. At the outbreak of the Civil War she became known as a speaker, and under the stimulus of the great events became an orator of great power and persuasiveness, who created by her youth, real pathos, and brilliant rhetoric the greatest enthusiasm wherever she was heard. She was called the 'Joan of Arc' of the War. Some of her books are: 'What Answer' (1868), a novel; 'A Paying Investment' (1876); 'A Ragged Register of People, Places, and Opinions' (1879). She was the author of two plays of excellent dramatic quality: 'Anne Boleyn,' and 'Marie Tudor' (1875), in which she played the title roles.

**Dickinson, Charles Monroe**, American author: b. Lowville, N. Y., 15 Nov. 1842. He was admitted to the bar in 1865, and practised law until 1877 in Binghamton and New York; in 1896 he was elected presidential elector, and has been United States consul-general to Turkey from 1897. He has published a book of poems entitled 'The Children and Other Verses' (1889), the title poem of which has received remarkable popularity; and a 'History of the Dickinson Family' (1885).

**Dickinson, Daniel Stevens**, American lawyer: b. Goshen, Conn., 11 Sept. 1800; d. New York 12 April 1866. He was admitted to the

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New York bar, where he soon became prominent; was elected to the State Senate in 1836, and became a leader in the Democratic party, which made him lieutenant-governor in 1842, and in 1844 sent him to the United States Senate. There he became known for his pro-slavery and States-rights proclivities, and was made chairman of the Finance Committee. He was brought forward as a candidate for the presidency in 1852, but without success. He spent the later part of his life at Binghamton, N. Y., in the practice of his profession.

**Dickinson, Donald McDonald**, American lawyer: b. Port Ontario, N. Y., 17 Jan. 1846. He was graduated at the law department of the University of Michigan in 1866, and began the practice of law in Detroit, where he rapidly rose to a foremost position at the bar; and later practised in Washington, D. C. He was conspicuous in politics as a Democrat; was secretary of the Democratic State Central Committee, which managed the Greeley campaign in 1872; withdrew from the Democratic party, but was won back by Mr. Tilden; and was chairman of the Democratic National Committee in 1876; and a member of the committee in 1884-5. He was postmaster-general of the United States in 1887-9; chairman of the Democratic National Campaign Committee in 1892; and senior counsel for the United States before the Joint High Commission on the Bering Sea claims, under the Fur Seal Arbitration in 1896-7.

**Dickinson, Emily**, American poet: b. Amherst, Mass., 10 Dec. 1830; d. there 15 May 1886. Living the life of a recluse, she wrote much verse in forms peculiar to herself, but she published almost nothing; although the few pieces that appeared attracted much attention. In 1890 a collection of her poems was issued which received warm praise from competent critics; another in 1892; and her 'Letters' in 1894.

**Dickinson, John**, American political writer and statesman: b. Maryland 13 Nov. 1732; d. Wilmington, Del., 14 Feb. 1808. He wrote a series of state papers: 'Address to the Inhabitants of Quebec'; 'Petitions to the King'; 'Address to the Armies,' that had great influence in their day. He was the author of 'Letters from a Pennsylvania Farmer to the Inhabitants of the Colonies' (1767); and 'Essay on Constitutional Power of Great Britain over the American Colonies' (1774). Dickinson College at Carlisle, Pa., was named in his honor.

**Dickinson, Jonathan**, American Presbyterian clergyman: b. Hatfield, Mass., 22 April 1688; d. Elizabethtown, N. J., 17 Oct. 1747. He was graduated at Yale College in 1706, and soon afterward was installed as pastor of the Presbyterian congregation in Elizabethtown, N. J., which relationship continued until his death. After the separation of the New Jersey churches from the synod of Philadelphia in 1741, it was determined to establish a collegiate institution in the former colony, and a charter for the College of New Jersey (now Princeton University) was obtained. The first classes were opened in Elizabethtown, and Dickinson was elected president.

**Dickinson, Martha Gilbert**, American poet: b. Amherst, Mass. She is a niece of Emily Dickinson (q.v.), and was married to

Alexander E. Bianchi 24 July 1903. She has published: 'Within the Hedge'; 'The Cathedral and Other Poems.'

**Dickinson, Mary Lowe**, American educator and author: b. Fitchburg, Mass., 1839. She was married to John B. Dickinson, a New York banker, and after his death taught in schools in Boston, Hartford, and New York, being for some time principal of the Van Norman Institute in the last-named city. She edited the 'Silver Cross' magazine for 10 years, and is now the editor of 'Lend a Hand.' She has published several volumes of fiction and a collection of poems.

**Dickinson College**, a coeducational institution in Carlisle, Pa., founded in 1783, under the auspices of the Presbyterian Church. The government of the school was changed somewhat in 1833, and it came under the charge of the Methodist Episcopal Church. In 1902 the number of students enrolled was about 490, and the number of volumes in the library was 35,000.

**Dickson, Frank**, English artist: b. near Chester, England, 1861. He was educated at Liverpool College, and studied art in the Royal Academy Schools. He has exhibited often in the Royal Academy as well as in many English galleries, and in Australia.

**Dickson, Samuel Henry**, American physician: b. Charleston, S. C., 20 Sept. 1798; d. Philadelphia 31 March 1872. He was graduated at Yale College in 1814, and immediately after commenced the study of medicine in his native city. He was instrumental in the establishment of a medical college in Charleston, and on its organization in 1824 he was called to the chair of institutes and practice of medicine. In 1858 he was called to the chair of practice of medicine in the Jefferson Medical College, Philadelphia, which he held till his death. He was author of 'Manual of Pathology and Practice of Medicine'; 'Elements of Medicine' (1835); 'Essays on Pathology and Therapeutics' (1845); 'Essays on Life, Sleep, Pain, etc.' (1852). It is a fact worthy of note that he delivered the first temperance address ever heard south of Mason and Dixon's line.

**Diclinous**, dik'lī-nūs or dī-klī'nūs, a Linnaean term for flowers possessing stamens or pistils only—*Monacia*, *Diacia*, and *Polygamia*.

**Dicotyledon**, dī-kōt ī-lē'dōn, a plant having two cotyledons or seed-leaves, that is, primordial leaves, contained in the embryo. The majority of flowering plants have this structure. When therefore seed is sown, in most cases the future plant first appears above the ground as a tiny two-leaved existence, and in certain cases the next pair of leaves which appear, and all the future ones, are of a different structure from the first. The primordial pair of leaves are the two cotyledons. Their use in the economy of nature is to shelter the ordinary leaves situated inside. In the plural the highest class of the vegetable kingdom, containing orders of plants with the structure of seed just described. It is a natural division and has other characteristics than that now mentioned; specially, new wood is added to the old externally, whence these plants are very often termed exogens. The dicotyledons comprise at least two thirds of all known plants.

## DICROTIC—DICTATORSHIPS IN LATIN-AMERICA

**Dicrotic Wave**, a double beating, as in the human pulse. Each pulse-wave begins with an ascent corresponding to the systole of the heart. This ascent usually forms, as registered by the sphygmograph, an unbroken line until the apex of the curve is reached and the descent commences. The descending curve is marked by several minor waves, one of which being quite pronounced is known as the dicrotic wave, and is probably due to a reflection of the arterial tension on the periphery.

**Dictator**, an extraordinary magistrate of ancient Rome, first appointed 501 B.C. At first no one was eligible to the office who had not been previously a consul. The power of naming a dictator, when an emergency arose requiring a concentration of the powers of the state in a single superior officer, was vested by a resolution of the senate in one of the consuls. A plebeian dictator was first appointed 356 B.C. The dictatorship was limited to six months, and the person who held it could not go out of Italy. The dictator had the power of life and death, and could punish without appeal. All the other magistrates were under his orders. He had 24 lictors, double the number allowed to a consul. Such were the dictators appointed to carry on the government of the state in special emergencies; but dictators were often appointed for temporary purposes, especially during the absence of the consuls. The object of these temporary appointments was generally to secure the discharge of some function which could only be lawfully performed by the first magistrate, as the holding of the comitia (or meetings) for the elections. The last dictator entrusted with the government of the state under the republic was appointed 216 B.C., the last temporary dictator 202 B.C. The office was revived by Sulla 82 B.C., and afterward held by Cæsar 48 B.C., but in these cases the legal restrictions were not regarded, and the office bore no resemblance but in name to the ancient dictatorship. It was abolished during the consulship of Antonius, 44 B.C. In more modern times usurpers have made themselves dictators. The rulers of Paraguay bore the title of dictator for a number of years, and those of other Spanish-American countries have done so from time to time.

**Dictatorships in Latin-America.** In Mexico, since the establishment of independence, there have been 10 acknowledged dictatorships, namely, those of Gen. Antonio Lopez de Santa-Anna, 1841 to 1842; Gen. Nicolás Bravo, 1842 to 1843; Santa-Anna again, in 1843; Gen. Valentín Canalizo, 1843 to 1844; Gen. Manuel María Lombardini, 1853; Santa-Anna again, 1853 to 1855; Gen. Rómulo Díaz de la Vega, 1855; Gen. Martín Carrera, 1855; Gen. Juan Álvarez, 1855; Gen. Ignacio Comonfort, 1855 to 1857. The "usual alternations of anarchy and military rule"—the long period of internecine strifes, during which one president after another was summarily deposed—drew to an end about 1876. Gen. Porfirio Díaz succeeded Tejada in May 1877. He was re-elected in 1884, and since that time has remained at the head of the government. In Paraguay, three years after allegiance to Spain was renounced, the congress in October 1814 decided to make Doctor (of theology) José Gaspar Rodríguez Francia dictator for three years. Before the expiration of his term of office, another congress decreed that his

dictatorship should be perpetual. He died 20 Sept. 1840. Francisco Solano López (16 Oct. 1862 to 1 Mar. 1870), though constantly referred to as a dictator, was officially known as "president of the republic." By an act of congress, 16 Oct. 1862, he was made "president of the republic for 10 years," his father, Carlos Antonio López, having been president during the 18 years immediately preceding, that is, from 1844 to 1862. In Bolivia there was at first no need to employ the word dictator, simply because the constitution of that country, framed by Bolívar and accepted without change or even debate by the congress at Chuquisaca, 25 May 1826, conferred ample dictatorial powers upon a "president" who should hold office for life; nevertheless the higher title was repeatedly assumed or conferred (see BOLIVIA for list of presidents and dictators). In Colombia (when it included New Granada, Venezuela, and Ecuador), we find, first, military dictatorships established before 1827 by Páez in Venezuela and by Mosquera in Ecuador; and then the dictatorship of Bolívar, who assumed absolute sovereignty in 1828 over the entire Colombian federation. Almost immediately afterward the federation broke up. The racial aversion to such steady co-operation as the situation called for was intensified by extravagant theories touching the so-called sovereignty of each individual citizen. Thus, it was not merely true that the 21 wretched "sovereign states" of Venezuela could repudiate pecuniary obligations or violate treaties with impunity; that any of the states of New Granada could nullify a law of the federal congress; but it has been well said that every man fancied that he was governed by a "higher law" inherent in himself, and "when he declared against the government he was not a traitor, but only a revolutionist, asserting his inherent right as a 'sovereign.'" In Colombia, from 1830 to 1861, there was a revolutionary outbreak on an average every second year; Ecuador generated a revolution and a new constitution every four years; Venezuela was even more distressed by anarchy. Acceptance of a military despot seemed to be the only escape from these intolerable conditions. The revolutionist Mosquera declared himself dictator of the diminished Colombia in 1867. In Venezuela, as a separate country, the first ruler is sometimes called dictator, sometimes president; he was both by turns, and repeatedly. Similar versatility was exemplified in the troubled lands from Mexico to the far South: as a Venezuelan fashion it easily survived its forceful exponent, Páez. Three short-lived dictatorships were set up in succession just before Crespo entered Caracas in 1892. In Ecuador, the first Flores called a convention (1843) which expressed the temporary desire to entrust him with a magistracy so far above all others that it is superior even to the laws themselves. Again, on 2 April, 1882, President Veintemilla seized power as a dictator and held it for a year. In Peru, Gen. Bolívar was supreme dictator, both during and after the struggle for independence, his license having been granted by the revolutionary congress of 1824 and confirmed in 1826. In Argentina, Juan Manuel Rosas accepted (7 March 1835) an almost unrestricted dictatorship which was offered to him in the hope that he would restore order. He reigned "in a horrible manner, like a madman" up to the day of his defeat, 3 Feb. 1852. In Brazil, the

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first national congress convened on 15 Nov. 1890, after the expulsion of Dom Pedro II. One year later (Nov. 1891) President Fonseca proclaimed himself dictator on the strength of an invitation of officers of the Brazilian army; but his navy turned its guns on him, and he resigned. In Chile, there have been fewer revolutions, more frequent instances of submission to the mandates of a privileged upper class; yet at the beginning of 1891 President Balmaceda broke with national traditions, to adopt those of the continent of South America: he announced that he was dictator, when he was, in fact, only a party leader; he declared himself to be in favor of martial law, and by superior force he was crushed (see CHILE). In the history of Uruguay, the word "dictator" is not prominent, though the irresponsible government of Artigas, a *Gaúcho* ("Rough Rider") chief, bred disorder after 1814, and comparative stability was first assured after 1870, when the Paraguayan war ended. In Costa Rica (q.v.) several of the chief executive officers have been called dictators, with an intention somewhat less offensive because the policy of the government is conceded to have been, in certain respects, positively commendable. For the other republics of Central America and Santo Domingo, our readers are referred to the articles dealing with those countries, in which special circumstances are explained. The exercise of dictatorial powers by dictators without the name — rulers who had, or have, the title of president merely — will be found under SOUTH AMERICA.

MARRION WILCOX,

*Authority on Latin-America.*

**Dictionary** (Low Latin *dictionarium*, first used in the 14th century; from *dictio*, post-classical synonym for *verbum*, word). The various applications of the term, general and special, are so familiar that a detail would be of no service. Of its synonyms, it may be said that the Greek word "lexicon" is customarily restricted to a dictionary of ancient or Oriental languages, with definitions, etc., in the language of the supposed reader; "glossary" and "vocabulary" to dictionaries of the terms used in the special works to which they are attached. A glossary (called by the Germans *idioticon*, by the Italians *vocabolario*) is a defined list of unusual, antique, or foreign words; a vocabulary, in classical works sometimes called an index, belongs to a book in or text-book of a foreign language, and renders the foreign words into the reader's language, or the exercises of the latter into the foreign.

**Functions.**—The variation of kind with the variation of users and origin, common to all literature, is well exemplified in dictionaries. The original dictionary was a simple definer of words which a cultivated reading class was supposed not to know,—foreign, provincial, technical, obsolete, etc.; the modern dictionary of its own language attempted to exclude nearly all but the accepted vocabulary of current literature,—that is, what people knew already,—or at least what would be needed for such reading; the later ones increasingly include the means of understanding everything ever printed in a language. Two classes only, for obvious reasons, are still excluded (one of which the older ones gave), by reason of the change in audience from men to women and children: gross words, except a few too important philologically to be spared; and argot. The "abridged" diction-

aries for many years, with ludicrous logic, excised the difficult words and retained the familiar ones; the first to exercise common-sense and reverse this plan was Jabez Jenkins in his wonderful "vest-pocket lexicon," whose near 30,000 words contained almost all the unusual ones and the pronunciational cruces. The attempts to draw a line in full dictionaries are now recognized as injudicious: that a word or form of a word has gone out of use is the very reason it should be defined or at least cross-referenced. An incomplete record of the language is by so much unserviceable. Part of the exclusions resulted from the growth of a half-educated middle class who looked to it as a standard of taste. The French Academy at first omitted all technical terms, and all words assumed below its standard of elegant usage; but as this made the book half useless, and the omissions were credited to the Academy's ignorance or carelessness instead of its fastidiousness, it could not be maintained. Recent dictionaries attain the same end by marking words as "obsolete," "little used," "provincial," "colloquial," "slang," "vulgar," etc. The attempted arbitrament of pronunciations, though inevitable (being among the chief services for which they are consulted), will always remain a battle-ground embarrassing even to the umpires. Still more important, however, is a dictionary's value for the historical development of a language. No dictionary fulfils its best purpose which does not, as far as possible, trace the varying significations from their sources, with their development by metaphor or technical use; and any arrangement which obscures this is vicious; whatever temporary convenience may be subserved. As the validity of this development depends on citation of passages, these should be full, otherwise we have only the arbitrary assertion of the compilers. Back from even this lie the original etymologies of the words, which are of great value and even more interest; and the best dictionaries give them with their affiliations in other languages. All the irregular grammatical forms, and the particles by which words are inflected,—a sufficient grammatical apparatus for correct usage,—should be given as a matter of course. Syllabifications, divisions, etc., should also be indicated: in a word, the dictionary is a proof-reader's vademecum, and must contain all requisite material for him to use.

**Arrangement.**—The first condition of usefulness being that the items shall be easily found, no arrangement is tolerable except an alphabetical one, in all languages where the inflections are mainly terminal or after a consonant initial. This arrangement, however, may be used only in a key, making feasible other classifications for the main body; as in Roget's well-known 'Thesaurus' of synonyms, where the grouping is by ideas, in parallel column with the reverse ideas. This would be a very useful addition to the meagre lists of synonyms given in the large dictionaries; but it would need great labor and almost impossible accuracy of cross-referencing, as the group heads must be referred to from each word in its alphabetical place. A very useful variant is in the lists of technical terms of arts and sciences given under each main head in the 'Standard Dictionary.' Rhyming dictionaries are arranged alphabetically under the terminations. In etymological

dictionaries, attempts have been made to alphabetize by roots; but as no two scholars ever agree on the roots, the finding is largely guess-work, unless with a full alphabetical key, and scholars condemn the plan. In Semitic languages the arrangement is usually by roots. It was this necessity of arranging Volapük dictionaries, owing to the prefix-inflection involving a search in three or four places for one word, which as much as anything else prevented that "language" gaining favor. The arrangement of Chinese characters is almost incapable of any readily intelligible system, and is not settled by sinologists.

*History.*—The first dictionaries were used by the Assyrians and Babylonians, to explain not words, but signs. The ancient ideographs, when largely displaced by syllabified or alphabetic signs with phonetic values, rapidly became unintelligible; and syllabaries were therefore compiled, to define them in terms of the latter. The old Sumerian language, however, seems not then to have become "dead," being preserved by the colleges of priests for religious use; and foreign languages were learned from foreigners. These were inscribed in vertical columns, on clay tablets; they have been found in the great library of Asurbanipal (Sardanapalus—668-626 B.C.), at Nineveh, the source of our chief knowledge of Mesopotamian culture. Much the same sort of syllabaries seem to have been used by the Chinese and Japanese.

The ancestry of our own dictionaries, however, is Greek. Here we observe the usual progression from the special to the general. The typical modern dictionary is a complete or representative vocabulary of a language, present and historical, with definitions in its own or some foreign tongue; its object being to interpret either the meaning of the foreign tongue or the bygone part of its own, or the usages and history of the latter. But neither of these was thought of by the ancients. The small upper and priestly class settled their own usages of language, there was no half-educated reading populace relying on books for correct form, there was no foreign literature they cared to read, and foreign conversation they learned from conversation. Their first dictionaries were the same as our special vocabularies. The oldest surviving one, by Apollonius of Alexandria in Augustus' time, was a glossary of Homer's words—probably the oldest of all kinds if we had them, Homer being the common text-book of Greece; others were of ambiguous, corrupt, barbarous, foreign, or dialectic phrases in the tragic and comic poets.—phrases Attic, Lacedæmonian, Cretan, Rhodian, Italian, Phrygian, etc.; others of technical terms in cookery, a fascinating subject to the Greeks; others of drinking vessels, of the cries of animals, of synonyms, etc. Besides glossaries of Homer, there were others of Plato, the Ten Attic Orators, Hippocrates, etc. All of these, so far as preserved,—unhappily, very few of them are preserved, and Athenæus in the 2d century gives the names of 35 lost to us,—are of priceless value both for words and antiquities. On a larger scale were the Onomasticon ("word-book") of Julius Pollux, arranged topically in 10 books, which has survived; and a great lexicon, now lost, written by Helladius of Alexandria about 400 B.C. Of others may be noted an

etymological dictionary by Orion of Thebes about 450, the first we have,—for Varro's essays in Roman etymology can hardly be called a dictionary; a dialectic and local one by Hesychius of Alexandria, in the 4th century; and one of words similar in sound, but unlike in meaning, by Ammonius of Alexandria. Coming down to the Middle Ages, the most famous is that of Suidas, of unknown date or place, but probably about the 10th century; it is a slovenly compilation of words, names, and places, but extremely valuable from its matter, not to be had elsewhere. Overleaping some centuries and their works, we come in 1572 to the mightiest of all, the tremendous 'Thesaurus Græcæ Linguae' of the famous French scholar and printer, Henri Estienne or Stephanus (q.v.), Geneva, 4 vols., folio, a work gigantic not only in size but in scholarship; it was last reprinted by Didot at Paris, 1831-65, ed. Dindorf, 9 vols. folio, 9,902 pages. All the mediæval and modern lexicons till the 19th century were Greek into Latin; the first Greek-English one was not till 1814, by John Pickering, and that was not finished; the first complete one was by John Jones, 1823, London. For many years the only general one on the market has been the Liddell & Scott, revised by Drisler, in its various editions. This, however, is confined to classic and early-empire forms, to common nouns, and to book words; and leaves need for several additional works. Later and mediæval Greek has been admirably covered by the lexicon of E. A. Sophocles, revised 1887 by J. H. Thayer; and a three-volume lexicon entirely devoted to the vast wealth of forms furnished by the inscriptions is in progress. Smith's dictionaries of antiquities and proper names are gone by, but the only ones in English; in German there are Pape's 'Greek Proper Names' (Griechische Eigennamen) 1875-90. There is one of modern Greek by Contopoulos, Athens, 1889; and there are special glossaries, New Testament and of various great authors, English-Greek, Yonge, revised by Drisler, latest edition 1893.

Less needful are details of Latin dictionaries, though they have been very plentiful; in the Middle Ages they were the daily necessity of all cultivated existence. They began much later than Greek: even the etymological treatise of the great M. Terentius Varro, Cicero's contemporary, preserved only in fragments, can hardly be called a dictionary; the first real one is of Verrius Flaccus under Augustus. One of Gutenberg's volumes was the 'Catholicon' or 'Summa' of Johannes de Janua (Giovanni Balbi), 1460. The monk Calepino published in 1502 at Reggio a Latin-Greek lexicon, which was so famous that for many years all dictionaries were called "calepinos"; in 1575 it was made a polyglot of Italian, French, and Spanish as well, and in 1590 extended to all languages, and many times reprinted. Robert Estienne, father of Henri above, published in 1531 at Paris a great 'Thesaurus Linguae Latinæ,' not supplanted till Forcellini's 'Totius Lexicon Latinitatis' in 1771, at Padua. All these were Latin into Latin, except that the latter had definitions also in Greek and Italian. A new edition with a large supplement, Prato, 1858-79, forms the greatest Latin dictionary ever published. The first Latin-English dictionary was the 'Promptorium Parvulum' of a Norfolk monk, Galfridus Grammaticus, compiled 1440,



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printed 1499; the first important one was by Sir Thomas Elyot, London, 1538. In the 18th century Robert Ainsworth's was for many years the only popular one (London, 1736). At present the two general popular ones are White & Riddle's (London, 1880), and Harper's (Andrew's Freund, revised by Lewis and Short, 1886). The great German-Latin one is Georges', 4 vols., Leipsic, 1880-5. The English-Latin are Smith & Hall, 1890; White & Riddle, 1869. A giant 'Thesaurus' was started in Leipsic, 1900, to outrank any other Latin lexicon in existence; it is to be edited by the greatest German scholars, under the supervision of the five great German academies, and has not yet finished the letter A. The great dictionary of mediæval Latin is Du Cange's, 1733-6, re-edited Paris 1882-8, 7 vols.

For modern European languages into English and *vice versa*, the following are standard: French—Smith, Hamilton & Legros, 1891; Spiers & Surene, 1891; Gasc, 1895. German—Thieme-Preusser, 1898; Flügel, 1891; Lucas, 1854-68; Whitney, 1877, valuable for etymology; Adler's, 1875, still unequalled for discrimination of synonyms. Spanish—Velazquez, revised by Gray and Iribas, 1901 (the old Velazquez's Seoane revised with a great new technical vocabulary). Portuguese—Lacerda, 1871; Michaelis, 1894; Valdez, 1879. Italian—Baretti, 1877; Meadows, 1869; James and Grassi, 1884; Millhouse, 1899. Dutch—Calisch, 1890. Danish—Ferrall, Repp & Rosing, 1873. Swedish—Wenström & Lindgren, 1889; Nilsson, Widmark & Bollin, 1889. Norwegian—Geelmuyden, 1886. Russian—Alexandrov, 1879. Turkish—Redhouse, 1880. Polish—Baranowski, 1884. Hungarian—Bizonfy, 1878-86.

The great foreign dictionaries of their own languages, corresponding to the 'Century Dictionary' or the 'New English Dictionary' of our own, are: French—Littré's, 4 vols., 1863-72, supplement 1878-82. Larousse's rich work is an encyclopædia. German—Jacob and Wilhelm Grimm, etc., the first volume published 1854, and the work is still unfinished. The brothers Grimm died 1859-63, and a succession of scholars have carried it on, but the parts appear slowly. Italian—Tommaseo and Bellini, four volumes in eight, 1861-79. Castilian Spanish—Dictionary of the Spanish Academy; Donadiu and Puignau, 1890-95; Cuervo's unfinished work, 1866-94. There is also a two-volume dictionary of Catalan, by Lobernia and Esteller. There are of course many other smaller but valuable etymological and historical dictionaries. Of other languages may be mentioned: Portuguese—Caldas Aulete, 1881. Provençal into French—Mistral, 1886. Sardinian into Italian, and *vice versa*, Spano, 1851. Dutch—Dale, 1885-9; Franck, 1884-92. Swedish—Kalkar, unfinished. Icelandic—Cleasby and Vigfusson, 1874. Welsh—Evans, 1887, unfinished. Irish—Foley, 1855; O'Reilly, supplement by O'Donovan, 1864. Russian—Dahl, 1862-73. Polish—Rydzewski, 1866. Slavonian—Miklosich, 1886. Turkish into Arabian and Persian, Zenker, 1866-76. Chinese into Latin, De Guignes, 1877; into French and Latin, 1869. Annamese—Pauthier, in Chinese characters with pronunciation in Chinese and Annamese.

Though Oriental and ancient, their close connection with our racial and religious ancestry and current problems makes Sanskrit and He-

brew worth noting separately. For the former, the great English works are by Monier-Williams: English-Sanskrit, 1851; Sanskrit-English, 1872. Hebrew, Fürst, 1867.

English lexicography on its own language begins very humbly, with John Bullokar's 'English Expositor,' 1616. More famous was Henry Cockeram's, 1623, which passed through nine editions up to 1650. Blount (1656), Philips (1658), and Coles (1677) succeeded these; but the first attempt at a thorough collection was Nathan Bailey's (1721.) This gave etymologies, marked accents, and remained the sole possessor of the field till Johnson's appeared in 1755; and was reprinted over a quarter of a century longer from its handy size, the 24th edition dating 1782. Johnson's, however, is the first of any importance from a scholar's point of view. The etymologies are superseded, but he was the first to make a dictionary something like a history of the language, with full (even over-full) illustrative examples, precise definitions, and attention to the form. It has been reprinted as late as 1866, but for popular use is superseded even in England by the great American dictionaries, and for scholars by special works. It did not mark pronunciation except by accents, like Bailey's. The first to enter on this unending task was Kenrick (1773); then came Perry (Boston, 1777); Thomas Sheridan (1780), the elocutionist, father of the great dramatist; Walker (1791), of immense vogue in its time and still cited as an authority, though entirely out of date; Smart (1836), based on Walker; all making their first claim as arbiters of elegant taste. Richardson (1836) was primarily for etymologies. Ogilvie's 'Imperial Dictionary' (1850, new ed. 1883) was the first of the great encyclopædic dictionaries; the 'Century Dictionary' was at first intended only as a slightly revised reprint of Ogilvie, but swelled into the magnificent work so well known. Previously, another English work of the sort had appeared, Hunter's, 1879-88. But the one monumental English dictionary is to be the 'New English Dictionary on Historical Principles,' edited by James A. H. Murray and Henry Bradley, greatly assisted by the late Fitzedward Hall, from matter collected by the Philological Society. It has reached the letter R at this writing, and will take several years to complete; and will form an absolute history of all English words and meanings. Noah Webster's first dictionary was in 1806, but the first edition of his epoch-making 'American Dictionary' was in 1828. This has become the 'Webster's International Dictionary' of 1890; always connected with Yale College scholarship, through Webster's son-in-law, Chauncey A. Goodrich, and later through Noah Porter. Webster was the founder of American lexicography, and by his enthusiasms and original ideas has left a permanent impress on American usages, even where his pet notions have been discarded. His work brought out its chief rival for many years, 'Worcester's Dictionary' (1860), by a scholar who had assisted him but disliked his innovations, and wished to substitute elegant usage for what he thought Webster's barbarisms. It had great influence for a generation, and has a tenacious tradition yet. The 'Standard Dictionary' (1893-5) is a medium between the com-



pression of Webster and the encyclopædic magnitude of the 'Century.'

Among special dictionaries may be named Jamieson's 'Etymological Dictionary of the Scottish Language,' 4 vols., 1879-82, with a supplement 1887; Wilson's 'Glossary of British India,' 1851, and Yule & Burnell's 'Anglo-Indian Words and Phrases,' 1886; Wright's 'English Dialect Dictionary,' about half finished; Bradley's 'Middle English Dictionary,' 1891; Taylor's 'Words and Places,' several revisions, and Blackie's 'Dictionary of Place-Names,' both etymologies of names; Bartlett's 'Dictionary of Americanisms' (1877), much too inclusive, and Farmer's 'Americanisms, Old and New' (1899); Roget's 'Thesaurus' of synonyms, last edition 1892.

**Dictys** (dik'tis) of Crete, a follower of Idomeneus in the Trojan war, whose name is attached to a professed journal of the leading events of the contest, which has come down to us in Latin prose, under the title 'Ephemeris Belli Trojani.' An introduction relates how the narrative, inscribed in Phœnician characters on bark-paper, was found in a coffer of tin in Dictys' tomb, which had been burst open by an earthquake in the reign of Nero, and how the emperor caused it to be translated into Greek; this is accompanied by a letter from one Quintus Septimius, who claims to have prepared the condensed Latin version that follows. This dates probably from the 4th century A.D., and though of no intrinsic value, was a chief source of the romances of the Middle Ages. The best editions are those of Dederich (Bonn 1832 and 1837), and Meister (Leipsic 1872).

**Dicyemidæ**, a family of very lowly multicellular organisms, parasitic in habit. They are found in cuttle-fishes, while related organisms known as *Orthonectida* occur in a brittle-star and in a nemertean worm. The largest species of the genus *Dicyema* measures five sevenths mm.; the smallest is 10 times less. These organisms hardly rise above the level of the embryonic gastrula, and some seem hardly to attain it, but it is still uncertain how much of this simplicity is primitive, and how much the result of degeneration.

**Dicynodon**, a genus of fossil reptiles occurring in a sandstone, supposed to be of Triassic age, in southern Africa and India. The principal remains yet found, the bones of the head, indicate a gigantic type between the lizards and turtles. The anterior portions of the jaws appear to have been altogether toothless, and they form a kind of beak, which was probably sheathed in horn. The lower jaw has no teeth; but each superior maxilla carries an enormous tusk-like tooth, growing from a persistent pulp. Eye orbits very large, cranium flat, with nostrils divided as in lizards. Order, *Anomodontia*.

**Didactic Poetry** (from Gr. διδακτικός, pertaining to teaching), has as its object the instruction of the ignorant. In the early ages of Greek literature there was no prose writing. Hesiod taught husbandry and theology in verse, Solon harangued in hexameters. Ever since that time verse has to some extent been used as a vehicle of teaching. The early Ionian philosophers, like Xenophanes, expounded their system in poetry, and, in the later days of the Roman republic, Lucretius, in the finest

didactic poem that was ever written, unfolded the theories of Epicurean materialism. Virgil wrote the 'Georgics' to teach the veterans of Augustus the art of agriculture, and Horace in his 'Art of Poetry' embodied for young Roman poets the Greek principles of dramatic writing, while Ovid set forth systematically the 'Art of Love.' Vida, the Italian, Boileau, the Frenchman, Pope, the Englishman, also wrote in verse an 'Art of Poetry.' English poets have been much inclined to didactic poetry. Darwin's 'Botanical Garden' is a treatise on the Linnæan systems of botany. The longer poems of Cowper are moral lectures. Dyer's 'Fleece' is the shepherd's guide, and even the 'Shipwreck of Falconer' may be looked upon as a manual of seamanship.

**Didelphia**, a group of mammals comprising the Marsupials (q.v.), so called in reference to the double condition of the generative organs, in the female. Compare *MONODELPHIA*, and see *METATHERIA*.

**Diderot, Denis**, dè nê dêd-rô, French philosopher: b. Langres 5 Oct. 1713; d. Paris 31 July 1784. 'Philosophic Reflections'—burned by the hangman and therefore widely circulated—and 'A Sceptic's Walk' (1747), were part of a warfare against the Church. In the compilation of the 'Encyclopédie' Diderot bore the main burden. He wrote all the articles on technology and industries, besides many of those on points of philosophy, and even on physics and chemistry. Further proof of his versatility is seen in the admirable reports he wrote (1765-7) of the art expositions at the Paris Academy. He wrote some dramas, but none of them possess any great merit. On the other hand, his novel, 'The Nun,' and his dramatic dialogue, 'Rameau's Nephew,' are wonderfully effective pictures of the corrupt society of the time. His little sketches, 'Little Papers,' are pearls of kindly humor and of witty narrative.

**Diderot and the Encyclopedists**, a literary study by John Morley, published 1890. This examination of the life, the work, and the influence of "the most encyclopædic head that ever existed" (as Grimm termed Diderot), and his fellow-workers, is an admirable monograph. Of all the literary preparation for the French Revolution the 'Encyclopédie' was the symbol; it spread through the world a set of ideas that entered into vigorous conflict with the ancient scheme of authority. Diderot, as the head of the movement, D'Alembert his coadjutor, Voltaire, J. J. Rousseau, Buffon, Helvetius, Holbach, Raynal, etc., with other famous persons of the day, as Goethe, Garrick, the Empress Catharine II.,—are here vividly depicted, with wide knowledge of books and of life, great skill in reading character, facility in disentangling causes and results, and broad philosophical perception of the historic position of the age. Anglo-Saxon readers find this work less one-sided than Taine's on the same subject. Appended to the book is a translation of the greater part of 'Rameau's Nephew,' Diderot's famous dialogue.

**Didier**, dê-dê-â, or **Desiderius**, the last king of the Lombards. He was Duke of Istria, and happening to be in Tuscany in 756, when Astolphus, the previous king, died childless, immediately raised an army and laid claim to the throne. Didier was crowned and seemed to

have secured the permanence of his dynasty by marrying his daughter to Charlemagne in 770. The marriage, however, proved unfortunate; and when Charlemagne dissolved it by repudiation, the quarrel between the families became irreconcilable. Didier afterward invaded the Papal States, and made a conquest of a part of them, when Charlemagne interfered. Didier, unable to oppose him, shut himself up in Pavia, when, after a siege of a year, he was obliged to surrender at discretion.

**Didier, Charles**, shārl, French poet and novelist: b. Geneva 1805; d. Paris 8 March 1864. He wrote some novels designed to awaken patriotic sentiment in Italy, and to make known the struggles of the Carbonari and other revolutionists against Austrian and papal dominion. Among these were: 'Underground Rome' (1833); 'The Roman Campagna' (1842); and 'Fifty Years in the Wilderness' (1857). His lyric poems, 'Melodies' (1827), are characterized less by force than by sweetness.

**Didier, Eugene Lemoine**, American author: b. Baltimore, Md., 22 Dec. 1838. He edited a weekly paper called 'Southern Society' 1867-9. Among his published works are: 'A Life of Poe' (1876); 'Life and Letters of Madame Bonaparte' (1879); 'Primer of Criticism' (1883); 'The Political Adventures of James G. Blaine.'

**Didier, Jules**, zhül, French painter: b. Paris 26 May 1831. He studied under Cogniet and Laurens, and won the prix de Rome in 1857. Among his works are: 'Farm on the Ruins of Ostia'; 'Normandy Landscape'; 'Hunting a Hare'; 'Morning on the Borders of the Wood'; 'Agriculture'; 'Ford near Autun'; and 'Return of the Drove.'

**Did'ius Sal'vius Julia'nus, Mar'cus**, Roman emperor: b. about 133 A.D.; d. Rome 1 June 193 A.D. Having filled the offices of quæstor, ædile, and prætor, he was appointed commander of a legion in Germany, and subsequently governor of Belgica. Having distinguished himself in Africa and Asia Minor, he returned to Rome, and, on the assassination of Pertinax, made himself emperor by bribing the prætorian guards. He now assumed the name of Marcus Didius Commodus Severus Julianus; but, after a short reign of two months was killed in his palace by a common soldier.

**Di'do**, queen of Carthage. She was the daughter of Agenor (Belus); according to others, of Carchedon of Tyre, from whom Carthage received its name; others call her father Mutgo or Muttinus. Her brother was Pygmalion, king of Tyre. Her father married her to her uncle Acerbas, otherwise called Sichæus or Siharbas. He was murdered before the altar by her brother, who was instigated by the desire of making himself master of his wealth. She therefore set sail for Africa, with all her wealth and her faithful companions. They landed on the coast of Africa, not far from Utica, a Tyrian colony. She purchased as much land as might be covered with the hide of a bull, which she cut into the thinnest possible strips, and surrounded with it a large extent of territory. Here she first built the citadel of Byrsa, and afterward Carthage. Hiarbas, a neighboring prince, paid his addresses to her. Unwilling to accept and unable to refuse the

proposal, she sacrificed her life on the funeral pile. By an anachronism common with poets, Virgil attributes her death to the faithlessness of Æneas. Dido was worshipped in Carthage as a goddess.

**Didon, dē'dōn', J. Henri, PÈRE**, French Dominican preacher and writer: b. 17 March 1840; d. 1900. He has attracted much attention for his series of eloquent Lenten sermons. Having come into conflict with his superiors because of his views about democracy, he ceased for a time to preach. His leisure was spent in preparing a life of Jesus, which should be an antidote to the skeptical 'Vie de Jesus' of Renan. This was published in 1891 under the title, 'Jésus Christ,' a book which made a great impression throughout France. He has also written 'Les Allemands' (1884).

**Didonceph'alus**, a monster with a double range of teeth, or a double jaw.

**Didot, Ambroise Firmin**, ān-brwāz fēr-mān dē-dō, French publisher: b. Paris 7 Dec. 1790; d. there 22 Feb. 1876. He was a son of Firmin Didot (q.v.) and with his brother Hyacinthe published such important works as 'L'Univers pittoresque'; 'Nouvelle biographie générale,' etc.

**Didot, Firmin**, French publisher, printer and type-founder: b. Paris 14 April 1764; d. 24 April 1836. He was a brother of Pierre Didot (q.v.). He was inventor of a new sort of script, and an improver of stereotype printing.

**Didot, François**, frāñ-swā, French printer: b. Paris 1689; d. 2 Nov. 1757. He founded the famous firm of Didot in Paris in 1713.

**Didot, François Ambrose**, frāñ-swā ān-brōz, French printer: b. Paris 7 Jan. 1730; d. 10 July 1804. He was a son of François Didot (q.v.), and invented many of the machines and instruments now commonly used in the typographic art. From his foundry came the most beautiful types that, up to that period, had been used in France, and he was the first person in France who printed on vellum paper. He took the greatest care to have his editions correct. By the direction of Louis XVI. he printed a collection of the French classics for the use of the dauphin. The Count d'Artois employed him to print a similar collection.

**Didot, Henri**, ōn-rē, French type-founder: b. 1765; d. 1852. He was a son of P. F. Didot (q.v.), and early distinguished himself as a type-engraver. He then applied himself particularly to improve the method of founding types, in which he succeeded by the invention of a new founding apparatus. He called his process "fonderie polyamatype." It is more expeditious than the former mode, and the types are much cheaper.

**Didot, Hyacinthe Firmin**, ē-ā-sānt fēr-mān, French publisher: b. Paris 11 March 1794; d. Dandon, France, 7 Aug. 1880. He was a son of Firmin Didot (q.v.), and with his brother, A. F. Didot, conducted the business of the house of Didot from 1827.

**Didot, Pierre**, pē-ār, French publisher and printer: b. 25 Jan. 1761; d. 31 Dec. 1853. He was a son of François Ambrose Didot (q.v.), and succeeded his father in the printing business in

## DIDOT — DIE AND DIE-SINKING

1789. In the universal impulse which the arts received from the revolution he aimed at becoming the Bodoni of France, and conceived the plan of a splendid edition of the classic authors in folio, which should excel, if possible, the best editions extant. He spared no expense to adorn them with all the splendor and elegance of the arts of design, and even sacrificed a part of his property to this favorite object. His 'Virgil' (1798) was worthy of these endeavors, and still more so his 'Racine' of 1801, which the French regard as the first typographical production of any age or country. Only 250 copies of these works were struck off. Among the productions of his press, Visconti's 'Iconographie' is particularly distinguished. Didot devoted the efforts of 10 years to the improvement of the types, and caused 18 different sorts, with new proportions, to be cut, with which he printed Boileau and the 'Henriade' in 1819. Didot paid no less attention to correctness and purity of text, and perfect consistency of orthography, than to typographical beauty.

**Didot, Pierre-François**, pē ār frāñ-swā, French printer: b. Paris 9 July 1732; d. 7 Dec. 1795. He was a son of François Didot (q.v.), and distinguished himself by his bibliographical knowledge. He also became printer to Louis XVIII. He had a great share in the changes made in the character of types, and contributed to the advancement of his art. He published some very fine editions; among them the 'Voyages d'Anacharsis.'

**Didron, dē'drōn', Adolphe Napoleon**, French archæologist: b. Hautvilliers, Marne, 13 March 1806; d. 13 Nov. 1867. He began in 1844 to publish 'Annales Archéologiques,' devoted to mediæval art and antiquities, which he continued to 27 volumes. This work was completed, long after his death, by the 28th volume, which included a general index. It is a valuable storehouse of mediæval art and archæology. His chief works are a 'Manual of Christian Iconography,' translated from an ancient manuscript, and 'Christian Iconography' (1843), which forms a history of the representations of the persons of the Trinity in art, their attributes, etc.

**Didun'culus**, a genus of birds allied to the pigeons, and comprising only the one species, *D. strigirostris* of the Navigator Islands. This bird is of special interest as being the nearest living ally of the extinct dodo. It has a length of about 14 inches, with a glossy plumage verging from a velvety black on the back to greenish black on the head, breast, and abdomen. The large beak, which is nearly as long as the head, is greatly arched on the upper half, while the lower is furnished with two or three tooth-like indentations.

**Didymæus**, did-ī-mē'ūs, a surname of Apollo, either because he was the twin-brother of Diana, or from the double light of the sun and moon, which he lends to men. Under this name Apollo had one of the most famous of his temples and an oracle at Didyma among the Milesians. Pindar calls Diana Didyma.

**Didym'ium** (Greek, "twin"), a supposed metallic element, isolated from the mineral cerite by Mosander in 1842. The symbol D or Di was assigned to it, and its atomic weight was con-

sidered to be about 143. The name referred to the close resemblance between the new metal and the element lanthanum, which had been discovered by the same chemist, and in the same mineral, a short time before. Recent researches have shown that didymium is not an elementary body, but that it consists principally of two other elements, which are respectively known as neodymium and praseodymium (q.v.). This discovery renders the name "didymium" singularly appropriate for the original substance.

**Didymus**, Alexandrian grammarian and critic: b. 63 B.C. He was a prolific writer, being celebrated for a treatise on harmony. The difference between major and minor whole tone, recognized by him, is known to this day as "the comma of Didymus," and some modern composers have written in his system. He belonged to the school of Aristarchus, and was contemporaneous with Cicero. By Seneca his works were estimated at 4,000, none now extant.

**Die** (*Dea Vocontiorum*), the capital of an arrondissement in the department of Drôme, France, is situated on the right bank of the Drôme, at the foot of Mount Glandaz, in a wide and fertile plain. The manufactures are woolen cloth, paper, leather, and silk; there is some trade in cattle and wood, and the neighborhood produces excellent fruit, and the white wine called "Clairette de Die." The town was formerly the seat of a bishop, and previous to the revocation of the Edict of Nantes in 1685, of a Calvinistic university. Among the interesting structures of Die are the old cathedral, with granite columns from an ancient temple of Cybele, and a porch of the 11th century; the episcopal palace, the walls flanked by towers, and the ruins of a castle—all of considerable age, the triumphal arch on the road toward Gap, known as the Porte St. Marcel, portions of an aqueduct, and other Roman remains. There are several mineral springs in the vicinity.

**Die and Die-sinking.** A die for making a medal or the like is a design engraved on softened steel, which is later hardened, and impressed or sunk in another softened steel surface, for the purpose of making duplicates. While the impressing of a die is specifically die-sinking, the entire art or business of making such dies is generally known by this name. The softened steel original die, on which the engraving is done, is termed the matrix. The relief formed by sinking is a relief-die or punch. This punch after hardening may be sunk into other soft steel surfaces, thus forming duplicates of the original, while the engraved die is laid aside to make more when the punch becomes worn. The duplicates, of course, are also hardened before use.

In making dies for coins or the like, a drawing of the exact size is first made, and from this drawing a tracing is taken for the purpose of transferring to the die. The soft steel blank, which is to form the die, is coated with a thin layer of transfer-wax. The tracing is reproduced on the wax, and the design scratched on the steel through the wax. The design is then deepened by the use of graving tools.

Dies for forming blanks, sometimes termed blanking-dies, have no design, but the punch

is shaped to the outline of the blank, while the female die is shaped so that the punch exactly fits into it. A shearing or cutting edge is given to either the punch or female die, and when the two are fixed in a press, they serve to cut out blanks from a sheet of metal. Where a large number of small duplicate blanks are wanted such dies are usually made in gangs, sometimes being fitted on rollers, so that the sheet of metal, from which the blanks are to be cut, is simply passed between the rolls.

A bending die is a device for bending a blank to some specific form. Such are used in connection with making pedals for bicycles.

Drawing dies for shaping or reducing wire consist of hardened steel plates that are adjusted so as to form a hole of the size and shape to give the wire the desired diameter or cross section. This drawing process also serves to strengthen the wire.

Thread-cutting dies for forming the threads on screws, consist of a series of opposing cutters, arranged so that the depth of the cut increases as the work progresses. The rod that is to form the screws is rotated between these dies, or the dies rotated about the rod.

A great variety of miscellaneous dies are used in the stamping of metal, which operation is common in the manufacture of small metal articles.

For further information as to dies consult 'Dies and Die Making,' by Lucas, Providence, 1897.

**Diebitsch-Sabalkanski, Hans Karl** (hänts kārł dyī-bēch-zā-bāl-kān'skē) **Friedrich Anton**, Count, Russian general: b. Grossleippe, Silesia, 13 May 1785; d. Kleczwo, Poland, 10 June 1831. He was educated at the military school of Berlin, but in 1801 quitted the Prussian service for that of Russia. He served with distinction in the campaign of 1812; took part in the battles of Dresden and Leipsic, and was made lieutenant-general at the age of 28. He had the chief command in the Turkish war of 1828-9; stormed Varna; and made the famous passage of the Balkans, for which the surname of Sabalkanski was conferred on him.

**Diedenhofen, dē-dēn-hōf'ēn.** See THIONVILLE.

**Diefenbach, Lorenz**, lō'rēnts dēf ēn bāh, German philologist: b. Ostheim, Hesse, 29 July 1806; d. Frankfort-on-Main 28 March 1883. He was 12 years pastor and librarian at Solms-Laubach. In 1848 he settled at Frankfort-on-Main, where in 1865 he was appointed second librarian to the city. His literary industry was enormous, embracing poetry and romances, as well as those more ponderous works by which his name will live. His greatest books are: 'Celtica' (1839-40); 'Vergleichendes Wörterbuch der Gothischen Sprache' (1846-51); 'Glossarium Latino-Germanicum mediæ et infimæ ætatis,' a supplement to Ducange's well-known 'Glossary' (1857); 'Origines Europææ'; 'Hoch- und Niederdeutsches Wörterbuch' (with Wülcker, 2 vols. 1874-5).

**Dieffenbach, Johann Friedrich**, yō hān frēd'rīh dēffēn-bāh, German surgeon: b. Königsberg 1 Feb. 1794; d. Berlin 11 Nov. 1847. He was distinguished as an operator especially in the art of forming by transplantation new noses and lips.

**Dieffenbachia**, dēf-fēn-bāk'ī-ā, a genus of *Araceæ* (arum family), of which there are about 15 species, found in the woods of South America and the West Indies. Their leaves have sheathing petioles, and are often variegated. Their form of inflorescence is the spathe-enclosed spadix characteristic of the order, the spathe in *Dieffenbachia* being green or yellowish. The best-known species is the dumb cane of the West Indies (*D. seguina*).

**Diego Garcia**, dē-ā'gō gār-thē'ā, an island of the Indian Ocean, in lat. 7° S., and lon. 72° to 73° E., extends in an irregular horseshoe shape, and is 30 miles long, embracing between its extremities three minor islets (the Chagos Islands). It contains a spacious bay, and is very convenient for coaling purposes. The group has about 700 inhabitants, and is a dependency of Mauritius.

**Diégo Suarez**, swā-rās, a town and territory, owned by France, in the extreme north of Madagascar, on the east coast, a little south of Cape Amber. Pop. 5,000.

**Dielec'tric**, a name applied by Faraday to any medium through or across which electrostatic induction can take place. (See INDUCTION, ELECTROSTATIC.) Solids, liquids, and gases possess this property of transmission, though in differing degrees, and their dielectric value, or specific inductive capacity, is measured by the ratio of the capacity of a condenser in which each may form the insulator, to the capacity of the same condenser with a vacuum as insulator.

**Diel'man, Frederick**, American painter: b. Hanover, Germany, 25 Dec. 1847. He removed to the United States in childhood, and was graduated at Calvert College. He was a topographer and draughtsman in the United States Engineer Department 1866-72; studied art under Diaz at Munich, and established a studio in New York in 1876. He was the designer of the mosaic panels, 'Law' and 'History' in the new Congressional Library at Washington, D. C.; and was president of the National Academy of Design in 1900.

**Diēlytra**, dī-ē'lī-tra, a genus of plants belonging to the natural order *Fumariaceæ* or fumitories. The best-known in this country is the *D. spectabilis*, a native of northern China and the neighboring parts of Siberia, which was discovered in 1810, and is now everywhere common in Europe as a garden plant. It blossoms in April and May, and its long drooping racemes of purplish-red blossoms present a very graceful appearance. It grows freely in the open air, and only requires the protection of glass in the winter. It prefers a sunny position and a light but fertile soil, and may be propagated by division of the root. In Germany it receives the popular name of pendant heart or virgin's heart, from the shape of the blossoms.

**Diepenbeeck**, dē'pēn-bāh, **Abraham van**, Flemish painter: b. Bois le Duc 9 May 1596; d. Antwerp 1675. He first studied glass painting, and a number of windows in different churches in Antwerp are his work. Later he studied under Rubens. Among his paintings are: 'St. Norbert'; 'Ecstasy of St. Bonaventura'; 'St. Francis Adoring the Sacrament'; 'Entombment of Christ'; 'Neptune and Amphitrite'; and the 'Flight of Clœlia.'

Dieppe, dê-êp, France, seaport, in the department of Seine-Inférieure, 93 miles north-northwest of Paris. The harbor accommodation is extensive, there being an outer harbor and four or five inner basins or docks, and the depth of water is sufficient for vessels of considerable burden; but the entry to it is somewhat difficult. The manufactures include works in ivory, the most famed in Europe; works in horn and bone, lace-making, sugar-refining, and ship-building. Pop. 21,091.

**Dies Fasti et Nefasti**, dī'êz fās'tī ēt nē-fās'tī, a Roman division of days, with reference to judicial business, into working-days and holidays. *Dies fastus* was a day on which courts could be held and judgments pronounced; *dies nefastus*, a day on which courts could not be held nor judgments pronounced. Assemblies of the people could be held only on the former. *Dies interdicti* were half-holidays. Morning and evening were *nefas*; the time between morning and evening sacrifice *fas*. As will be immediately noticed the observance of these holidays (*feriæ*) bore a strong analogy to our Sunday with its suspension of business and visiting places of worship.

**Dies Iræ**, dī'êz ī'rē, the first two words used as the title of a celebrated Latin hymn on the Last Judgment. This incomparable hymn consists of 17 stanzas, with an 18th of 4 lines, and is based on the prophetic passage, Zephaniah, i. 14-18. It is probably the work of the Franciscan, Thomas de Celano, who died about 1255. The sublimity and force of its thoughts are well matched by the impressive solemnity of the verse, its stanzas of three lines, each with the same double rhyme, making the inmost soul tremble, "as with three blows of a hammer," says Guericke. It is said to have first appeared in the missals made at Venice about 1250, and is one of the five 'Sequences' that have been universally used in the Roman Catholic Church since the Council of Trent. Its place is in the *Missa in commemoratione omnium fidelium defunctorum*. The Tridentine text, published in 1567, is somewhat different from that in the old missals, and another and considerably inferior version appears on a marble tablet of unknown date, in a Franciscan church at Mantua. The *Dies Iræ* has been the subject of musical compositions by Palestrina, Haydn, Cherubini, and Mozart, and no religious poem has been more frequently translated. There are English translations by Crashaw, Macaulay, Lord Lindsay, Isaac Williams, and Gen. John A. Dix. The opening stanzas are paraphrased in the 'Lay of the Last Minstrel,' canto vi. Goethe has felicitously introduced a few stanzas into his 'Faust,' and, in his novel 'Ferragus,' Balzac has given a thrilling description of its effect, when sung at a funeral or requiem mass. The following is the full text:

Dies iræ, dies illa,  
Solvat sæclum in favilla,  
Teste David cum Sibylla.

Quantus tremor est futurus,  
Quando Juxta est venturus,  
Cuncta stricte discussurus!

Tuba mirum spargens sonum  
Per sepulchra regionum,  
Coget omnes ante thronum.

Mors stupebit, et natura,  
Cum resurget creatura,  
Judicanti responsura.

Liber scriptus proferetur,  
In quo totum continetur,  
Unde mundus judicetur.

Judex ergo cum sedebit,  
Quidquid latet apparebit,  
Nil inultum remanebit.

Quid sum miser tunc dicturus,  
Quem patronum rogaturus,  
Cum vix justus sit securus?

Rex tremendæ majestatis,  
Qui salvandos salvas gratis,  
Salva me, fons pietatis.

Recordare, Jesu pie,  
Quod sum causa tuæ viæ,  
Ne me perdas illa die.

Quærens me sedisti lassus,  
Redemisti crucem passus,  
Tantus labor non sit cassus.

Juste judex ultionis,  
Donum fac remissionis,  
Ante diem rationis.

Ingemisco tanquam reus,  
Culpa rubet voltus meus  
Supplicanti parce, Deus.

Qui Mariam absolvisti  
Et latronem exaudisti  
Mihi quoque spem dedisti.

Preces meæ non sunt dignæ  
Sed tu bone, fac benigne,  
Ne perenni cremer igne.

Inter oves locum præsta,  
Et ab hædis me sequestra,  
Statuens in parte dextra.

Confutatis maledictis,  
Flammis acribus addictis,  
Voca me cum benedictis.

Oro supplex, et acclinis,  
Cor contritum quasi cinis,  
Gere curam mei finis.

Lacrymosa dies illa  
Qua resurget ex favilla,  
Judicandus homo reus;  
Huic ergo parce Deus.

Amen.

**Dieskau**, Ludwig August, lood'vīg ow'-goost dēs'kow, German general in French service: b. 1701; d. Surene, near Paris, 8 Sept. 1767. He was adjutant of Marshal Saxe, whom he accompanied in the campaigns against the Netherlands, and became in 1748 brigadier-general of infantry, and commander of Brest. In 1755 he sailed as field marshal to Canada, at the head of French troops, to assist in the campaign against the English. He ascended Lake Champlain with the design of attacking Fort Edward, defeated a detachment sent for its relief, and pursued them to the fort with the hope of entering it with them. He was, however, defeated.

**Diest**, dēst, Belgium, town in the province of Brabant, 32 miles northeast of Brussels. It was once strongly fortified. Pop. 8,531.

**Diet**, a meeting or assembly of delegates or dignitaries convened and held from day to day for legislative, ecclesiastical, political, or administrative purposes; specifically, the legislative assemblies of the German empire, Austria, the cantons of Switzerland, etc. The Diet of the German empire was composed of three colleges; one of electors, one of princes, and one of imperial towns, and began with the edict of Charles IV. in 1356. Each college deliberated by itself the agreement of all three together with the assent of the emperor being finally necessary for passing judgment. The best-known meetings were those at Nuremberg 1467, Worms

## DIET — DIETETICS

1521 (at which Luther was excommunicated), Spires 1529, and Augsburg 1530.

**Diet.** See NUTRITION.

**Dietetics** is the branch of hygiene that deals with the recovery or maintenance of health by right habits of eating and drinking. Diet is the daily fare regulated in accordance with a scientific study of foods and of the needs of the human body. The words diet, dietetics, and dietary, in their modern significance, appear to have a mixed origin. The dictionaries trace their derivation through the French *diète* to the Latin *dieta* and the Greek *diatta*, the latter signifying a manner of living. Another meaning, often marked archaic or obsolete by lexicographers, is "daily fare," "allowance of food," "daily pay."

And for his diet, there was a continual diet given him of the king of Babylon, every day a portion until the day of his death, all the days of his life.—Jeremiah lii. 34.

This meaning has an evident connection with the Latin *dies*, day, and is followed in the modern use of the word dietary. As defined by Mrs. Ellen H. Richards, a dietary is "a known amount of food, of known composition, per person, per day." Popularly, dietary appears to

periments of German chemists. The *erbswurst*, or pea sausage, a food having merit for emergencies, was devised by scientists at that period. Oleomargarine was the result of experiments made for the navy under direction of the French government. The aim of dietitians of the present day includes all that has gone before, the best use of materials at hand, prescription of food for the sick, and aid to the well in choosing such foods as shall maintain health, with due regard to pleasing the palate. The 20th century finds prevention wiser than cure, and endeavors by the prescription of food adapted to different ages and conditions of body to develop the sound body and sane mind. At the present time no less emphasis is laid upon diet for diseased conditions of the human body than in the past, but more attention is being given to building up healthy bodies, and then sustaining them by foods chosen with special reference to the work each individual has to do. Some study of dietetics is now included in the preparation of the citizen for life. In the public schools it is a part of the lessons in physical training, cooking or domestic science. A practical course in dietetics would cover the source and manufacture of foodstuffs, the processes of cookery

UNITED STATES DEPARTMENT OF AGRICULTURE. *Nutritive Ingredients (or nutrients) of food.*

Food as purchased contains —	Edible portion .....	Water.	Nutrients .....	Protein. Fats. Carbohydrates. Mineral matters.
	Refuse, .....			

e. g., flesh of meat, yolk and white of eggs, wheat, flour, etc.

e. g., bones, entrails, shells, bran, etc.

*Uses of nutrients in the body.*

Protein .....	Forms tissue .....	All serve as fuel to yield energy in the forms of heat and muscular power.
e. g., white (albumen) of eggs, curd (casein) of milk, lean meat, gluten of wheat, etc.		
Fats .....	Are stored as fat.....	
e. g., fat of meat, butter, olive oil, oils of corn and wheat, etc.		
Carbohydrates .....	Are transformed into fat...	
e. g., sugar, starch, etc.		
Mineral matters (ash).....	Share in forming bone, assist in digestion, etc.	
e. g., phosphates of lime, potash, soda, etc.		

be associated with cheap fare, perhaps because first used in connection with the allowance of food for paupers and prisoners. The word diet also conveys to the average mind the idea of a reduced food supply, probably because the individual choice is restricted.

Under primitive conditions, men satisfied hunger with any edible substances within reach. The progress of civilization, with the increase of material possessions, developed the epicure and gourmand, who magnified the pleasures of the table. The aid of the physician was then required to mitigate woes induced by over-indulgence. In the days of Hippocrates, dietetics was the province of physicians, who thus aimed to undo the evils caused by wrong living. Later, economists like Count Rumford applied dietetic principles to feeding the poor of European cities. Some countries have employed experts to prescribe rations for keeping army and navy in fine physical condition at least expense to the government. The victory in the Franco-Prussian war of 1870 has been ascribed to the food ex-

and wise combinations of foods, the calculations of dietaries for individuals, families and institutions, and the adaptation of foods to individual needs according to age, sex, climate and occupation. Students of history and sociology are recognizing the effect of food in forming individual and national characteristics. The French revolution, and the destruction caused later by the Communists, has been ascribed to the ill-fed condition of the people.

Fresh air, pure water, and clean food are more essential for nutrition than any special selection of foods. The surroundings and instincts of a people lead them to adapt their diet to the climate. In the tropics fruits and vegetables are the main sources of subsistence, in arctic regions foods are chiefly animal and largely fat, supplying the heat needed by bodies subjected to severe cold. A mixed diet, both animal and vegetable, has produced the most successful races.

The usual classification of food substances is outlined by the United States Department of Agriculture in the above table.



## DIETETICS

Sometimes it appears difficult to reconcile practical usage and scientific experiment as to food values, but this is due to an incomplete view of both sides. Many statements about foods are untrue because only one phase is presented. To decide upon the full value of any food we must consider both its physical and chemical composition, its economic value and its physiological effect in the body. The elimination of refuse, and the division and subdivision of particles in the process of manufacture are important factors in the nutritive value and digestibility of foods. Some experiments have shown that a larger percentage of peas and beans was digested when thoroughly cooked and sifted, after removing the hull, than when cooked whole. Such external digestion saves energy in the human organism. Whatever tends to cleanse and purify foods before cooking undoubtedly increases their real nutritive value. Medical authorities on dietetics have laid much stress upon the choice of foods, but hardly enough upon their preparation. A piece of meat or a vegetable, however innocent in itself, may be ruined in cooking, while one of doubtful value, by right processes of cookery, may become harmless and even useful. This is equally true from the economic standpoint. Count Rumford found that "the richness or quality of a soup depended more upon the proper choice of ingredients and a proper management of the fire in the combination of these ingredients, than upon the quantity of solid nutritious matter employed; much more upon the art and skill of the cook than upon the sums laid out in the market." The nutritive qualities of many foods are doubtless made more available by a wise use of flavors, which in themselves contain little or no nutriment. Condiments and spices, tea and coffee, and the extractives of meats are of special value for the flavor which they impart. The cheap substantial grain foods after all provide the larger part of the food of the human race, and are made palatable by changes in flavors.

The hours and arrangement for meals have an influence in the assimilation of food. Breakfast in America is a more substantial meal than it is in Europe, perhaps from climatic conditions. The midday dinner seems best adapted to children and invalids, the night dinner is a concession to the competition of business. One dietetic authority estimates that more than half of the day's ration of protein and fat and one third of the carbohydrate is taken at dinner. Therefore the hour of the meal should be such as to provide for a period of rest afterward. The savage gorges himself when food is abundant, then sleeps like an animal. The gourmand of classic days took an emetic to relieve his stomach that he might partake of delicacies yet to come. The best thought of the present day tends to shorter menus and simpler compounds, toward "plain living and high thinking."

Dietetic theories vary from age to age because of imperfect knowledge of bodily processes, or because of changes in the production and preparation of foods. Water, for example, was once excluded mainly from the dietary of patients suffering from fevers, and its use restricted in other cases. Now it is recognized that a lack of water in the diet is a serious error, and that many of our

foods as served are not sufficiently diluted with water. In the past an exaggerated nutritive value was ascribed to beef tea and to gelatine, but later investigations show that the one should be classed as a stimulant, and the other not so much a real food as a protein sparer. Other points regarding which opinions have changed are these: The relative merits of different preparations of wheat, especially of the whole wheat and white flours. The former is probably better for young children, because it supplies bone-making material, but by modern methods of milling most of the nutritive material in the grain is retained in the best grades of white flour. The natural instinct of children for sweets has been repressed, but now sugar is recognized as a valuable food, provided it is taken at proper times. Oysters are less nutritious than is popularly supposed, and as ordinarily cooked are not especially easy of digestion. Combinations of foods often produce different effects from the separate ingredients, and small quantities of certain things may be helpful where larger quantities would produce bad results. A food may be nutritious, economic in the true sense, and prepared in such a way as to be easily acted upon by the digestive organs, and yet fail of perfect assimilation because it does not suit the habit or whim of the eater. In popular estimation a food is digestible when no feeling of discomfort follows after eating it, or when it is easily and quickly digested. The scientist considers a food digestible in proportion as it is completely digested whether the time be shorter or longer. Persons in health should consume some foods that digest slowly, and beware of depending upon pre-digested foods. If allowed to be idle, the stomach, like any other organ, soon finds it difficult to work.

The seven ages of man described by Shakespeare might illustrate the different periods of life calling for a change in diet.

The infant thrives and grows on a diet of milk. When the mother cannot supply a sufficient amount, clean milk from a healthy cow, by dilution with water or whey and by modification with milk and cream, may be adapted to the increasing needs of a baby as it develops. Greater cleanliness in collecting and transmitting milk to consumers is a first requisite for the diet of young children. Defective nutrition causes indigestion, rickets, intestinal catarrh and many disorders of childhood.

The schoolboy requires abundant food from which to construct his rapidly growing body and to provide energy for his active exercise. With him quantity is often more important than quality, while his sister, enjoying less active sports, is over-fastidious. Dainty children and excessively greedy ones both are usually ill fed. Nervous diseases of children, even stammering, will yield to more careful diet. Milk, fruit, cereals, whole wheat bread, eggs and vegetables should form the bulk of the diet of school children. The school luncheon now receives considerable attention from educators.

The lover and the soldier represent the college days and the strenuous life of early manhood. The training-tables for athletes in school and college are an admission of the need of a selected diet for special work. The definition of an army, given by a famous general—an animal that crawls on its stomach—indicates

## DIETETICS

the importance of proper food for the soldier. No less necessary is it for captains of industry, pioneers and explorers of all kinds. Personal idiosyncrasy and differentiation of occupation demand attention to the individual dietary.

The justice is the type of the prosperous man of sedentary habit who is often overfed, and who should begin modifying his diet after passing the half-century mark, but habits are formed and changes must be made gradually. Luigi Cornaro, an Italian who lived in the 15th and 16th centuries, began at 40 to modify his diet and succeeded in passing the century limit. After he had reached 80 years he wrote several treatises describing his manner of living. That his writings are still the basis for much that is written on diet for the later years of life, is a sad commentary on the self-indulgent habits of the human race, which shorten many valuable lives.

I have come to the conclusion that more than half the disease which embitters the middle and latter part of life is due to avoidable errors in diet, . . . and that more mischief in the form of actual disease, of impaired vigor and of shortened life, accrues to civilized man . . . from erroneous habits of eating than from the habitual use of alcoholic drink, considerable as I know that to be.

SIR HENRY THOMPSON.

Last of all comes old age, and for this period the food should be similar to that of the young child, and taken often in small quantities. In proportion as activity diminishes, the intake of food should decrease. The sense of taste is dulled and higher seasonings may be desirable. Here if anywhere in a normal diet the stimulus of alcoholic beverages may be allowed.

During the last of the 19th century much data has been collected showing how people actually live, the cost of living and the proportions of protein, fat and carbohydrates. The studies on food and dietaries conducted by the United States Department of Agriculture have furnished much valuable data which is being used as the basis of further work on dietetics by authorities on both sides of the Atlantic. From such studies may be deduced approximate dietaries for different conditions. The ration enabling a man to do good work must necessarily be larger than one calculated merely to sustain life.

An estimated life ration for one day, measured in grams:

Protein.	Fat.	Carbohydrates.	Calories.
75.	40.	325.	2,000.

When poor families are found living on rations lower than this their diet must be enriched before they can be expected to display much energy. Prisoners often have different rations according to their time of sentence in some reformatories, and a man refusing to work is fed with stimulating food until he desires to expend some of his accumulated energy. A work ration would provide in grams:

Protein.	Fat.	Carbohydrates.	Calories.
125.	125.	450.	3,500.

For severe labor this would be increased. (The calory is approximately the amount of heat which would raise one pound of water 4° F. and is a convenient standard of measure of the fuel value of food. The fuel value of protein is 4 calories per gram, or 1,820 calories per pound; fuel value of fats, 8.9 calories per gram, or 4,040 calories per pound; fuel value of carbo-

hydrates, 4 calories per gram, or 1,820 calories per pound.)

The estimate of the value of food in construction of new tissues is less simple than its fuel value. It is impossible to measure the amount of good that might be done in schools, hospitals, and public institutions by improving the conditions of diet. Many hospitals now employ trained directors to make dietaries and superintend their preparation. The United States Department of Agriculture issues many valuable dietary bulletins.

Diet for the sick may be considered under three general heads: the typical ration for invalids, in fluid form, suitable for the crisis of acute disease; food for the convalescent or for building up a body wasted through lack of nutrition; and last, such diet as may aid in the reduction of an overloaded body but yet sustain the vital forces. For the first few days of an acute illness the human body may sustain itself on the surplus stored in its tissues. An invalid in bed is not using up energy so fast as the man at work, hence the diet should be less generous, not a work ration but a life ration increased in such directions as may best combat the waste of disease. Liquids are easily taken, quickly absorbed, and as a whole are less irritating than solids to the digestive organs. Concentrated foods are necessary in certain conditions, but these are few. A sick person for the time being is to be fed much like an infant—small quantities of food should be given often, usually warm rather than cold. Pre-digested foods should not be used until ordinary forms fail. Where there are wasted tissues to repair—as in convalescence or in diseases like anæmia, nervous prostration, or tuberculosis, the diet must be generous—milk and eggs are the main dependence, and the art of cookery has devised many simple ways of serving them. Fat, in easily digested forms—olive oil, bacon, cream, and butter—is valuable in such cases, because fat is two and a fourth times as valuable for fuel food as the carbohydrates. For the capricious appetite attractive arrangement and service of the food, and the element of surprise are important. The cookery for the sick conforms to the usual formulas, though greater attention must be given to the selection of food and its preparation, and all doubtful articles must be avoided. Starches should be thoroughly cooked, woody fibre reduced by cooking and mashing, or removed by straining. Animal foods should be cooked at low temperature. High, composite seasonings are not desirable, but a moderate use of simple flavors is admissible. Gout, rheumatism, and obesity may not be due to over-eating in one sense, but indicate an excess of certain substances which are neither assimilated nor eliminated, but are stored up in the various tissues, causing discomfort. The many fasts of the early Church perhaps were introduced less as a religious duty than as a wise dietetic measure. The "Banting" system for the reduction of fat consists mainly in decreasing the allowance of starch and fat and increasing the protein. Special diets for other diseases should, like medicine, be prescribed by the physician in charge, because of the complications to be considered. Water-cures, milk-cures, and grape-cures have been successful in some cases. Increased knowledge of bacteria has explained many heretofore

## DIETRICH — DIFFERENTIAL THERMOMETER

mysterious cases of poisoning, and has changed the point of view regarding the wholesomeness of various food products. Greater attention to cleanliness in all preparation of foods would make the use of preservatives practically unnecessary. With our rapid increase in prosperity Americans in future need to guard against over-indulgence of the sense of taste and to control the appetite to accord with the true needs of the body.

*Bibliography.*—Some of the most useful books on this subject are these: Abel (Mary H.), 'Practical Sanitary and Economic Cooking'; Atwater (W. O.), 'Principles of Nutrition and Nutritive Value of Food' (United States Department of Agriculture); Burnett (R. W.), 'Foods and Dietaries'; Chapin (H. D.), 'Theory and Practice of Infant Feeding'; Dukes (Clement), 'School Diet'; 'Food as a Factor in Student Life' (University of Chicago); Fothergill (J. M.), 'Manual of Dietetics'; Hart (Alice M.), 'Diet in Sickness and Health'; Holt (L. E.), 'Care and Feeding of Children'; Hoy (A. H.), 'Eating and Drinking'; Hutchison (R.), 'Food and Dietetics'; Knight (Jas.), 'Food and Its Functions'; Langworthy (C. F.), 'Dietary Study of Groups, etc.' (Bulletin United States Department of Agriculture); Miles (E. H.), 'Muscle, Brain, and Diet'; Richards (Ellen H.), 'Cost of Food'; 'Plain Words About Food'; Richards and Williams, 'Dietary Computer'; Thompson (Gilman), 'Practical Dietetics'; Thompson (Sir Henry), 'Food and Feeding'; Yeo (I. B.), 'Food in Health and Disease.'

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**Dietrich, dêt'rîn, Christian Wilhelm Ernst**, German painter: b. Weimar 30 Oct. 1712; d. Dresden 24 April 1774. The picture of a peasant drinking, in the Dutch style, executed by Dietrich while a boy, is in the Royal Cabinet of Engravings at Dresden. He successfully imitated Raphael and Mieris, Correggio and Ostade. His paintings are scattered through almost all Europe. In the Dresden gallery, of which he was inspector, there are 34 of them.

**Dietrich von Bern, fôn bër'n**, a hero of German legend, celebrated for his amazing adventures, and figuring in the 'Nibelungenlied.' He was in actual life Theodoric the Great, founder of the Ostrogoth monarchy; but the two names have resulted in much confusion of legend with fact. He flourished in the 5th and 6th centuries of our era. Bern is German for Verona, the principal residence of Dietrich.

**Dietrichson, dê'trîk-sôn, Lorents Henrik Segelcke**, Norwegian poet and historian of art and literature; b. Bergen 1 Jan. 1834. While an undergraduate in the University of Christiania, he composed many clever student songs which were collected and published in 1859. He published the poem 'Olaf Liljekrans' in 1857, and 'Kivleslätten' in 1879. His writings are numerous and among them are: 'Didactic Poetry in the North' (1860); 'The Art of Wood Sculpture in Norway' (1879).

**Dieu et Mon Droit, dê-ë ã môn drwâ** (Fr. signifying "God and my right"), the motto of the arms of England, first assumed by Richard I., who flung this battle-cry at his French adversaries during the engagement at Gisors, 1195, to

intimate that he did not hold his empire in vassalage of any mortal. It was revived by Edward III. in 1340, when he claimed the crown of France. Except during the reigns of Elizabeth and Anne, who used the motto, *Semper eadem*, and of William III., who used *Je maintiendray* as his own motto (*Dieu et mon droit* being retained on the great seal), it has ever since been the royal motto of England.

**Dieulafoy, Jeanne Rachel Mayre, zhôn rã-shêl mâr dê-ë-lã-fwâ**, French descriptive writer and novelist: b. Toulouse 29 June 1851. She is the wife of A. M. Dieulafoy (q.v.). Her narrative of travel in 'Persia, Chaldæa, and Susa' (1886), and her fiction 'Parysatis' (1890); and 'Rose d'Hatra' (1891), are evidences of her talent.

**Dieulafoy, Auguste Marcel**, French engineer: b. Toulouse 3 Aug. 1844. In 1885 he discovered in Persia the remains of the royal residences of Artaxerxes. His discoveries are described in his 'L'art antique de la Perse' (1884-9).

**Diez, dêt., Friedrich Christian**, German philologist; b. Giessen 15 March 1794; d. Bonn 29 May 1876. Having qualified himself as a lecturer at Bonn, he was appointed professor of modern languages there in 1830. In addition to various works on the poetry of the Troubadours, he published a very valuable 'Grammatik der Romanischen Sprachen' (1836-42), which was translated into English, and an 'Etymologisches Wörterbuch der Romanischen Sprachen' (1853), also translated into English. Diez laid the foundation of Romance philology, and to him all later investigators are profoundly indebted. His work stands in much the same relation to the Romance dialects as the researches of Grimm occupy with respect to the German dialects.

**Difference**, in heraldry, an additional figure or an alteration in a coat-of-arms to distinguish one family from another of the same strain, or particularly to mark the difference between brothers and their descendants during the lifetime of the head of the house. Sometimes this is accomplished by variations of the bordure, such as having it ingrailed, invected, embattled, etc. But usually the eldest son bears a label or lambel; the second son, a crescent; the third, a mullet; the fourth, a martlet; the fifth, an annulet; the sixth, a fleur-de-lys; the seventh, a rose; the eighth, a cros-moline; the ninth, a double quatre-foil.

Such marks of heraldic distinction cannot be regulated by cast-iron rule or set law. Each country follows the customs resulting from its own particular régime, which seem to be the adoption of changes on an escutcheon best suited to individual needs. Difference is commonly confounded with Cadency (q.v.).

**Differential Calculus.** See CALCULUS.

**Differential Thermometer**, an instrument, for determining the difference of temperatures between two points or places. That of Sir John Leslie is one of the best known, and will be found described under THERMOMETER. His invention is now used only as a thermoscope. A pair of thermo-electric junctions (see THERMO-ELECTRICITY) is generally preferable to any other kind of differential thermometer. One of the junctions is put at one of the points, and the

## DIFFERENTIATION — DIFFUSION

other junction at the other point, and a galvanometer is introduced in the usual way into the circuit, great care being taken to keep all the other junctions of whatever kind that occur in the arrangement strictly at the same temperature. The strength of the current generated, which is measured by means of the galvanometer, is, with the limitation that will be found explained under the article just alluded to, proportional to the difference of temperature between the two thermo-junctions; and with the assistance of a previous experiment at known temperatures on the thermo-junctions employed, the absolute difference of temperature between the two points at which the junctions are placed may be determined with great exactness.

**Differentiation**, in biology, that organic process which occurs when certain parts of a uniform whole become structurally different from the others, or when, in other words, the homogeneous becomes heterogeneous. Inequality in internal and external conditions of life brings about restriction of certain vital processes and the predominance of others, and as this division of function is established, diversity of structure results. Differentiation is the structural change which is associated with the physiological "division of labor," and the process is essentially the same whether it find expression in cells, tissues, organs, or entire organisms. See DIVISION OF LABOR; EVOLUTION; VARIATION; etc.

**Diffraction of Light**, the bending of the rays of light, due to interference, as of the slits or ruled lines in a diffraction grating. The study of the diffraction of light has given us the spectrum, and the study of spectrums, through the spectroscope, has added greatly to the sum of human knowledge of the constituents of heavenly bodies. A simple way of noting the diffraction of light is to darken a room and allow a ray to penetrate between the edge of a shade and the window jamb. The light falling on the opposite wall is not a well-defined streak, like the aperture through which it passes, but is divided into a series of upright streaks or bands, showing that the rays of light bend or are diffracted in passing through the slit. Interesting experiments with diffraction can be made by allowing the light to pass through a hole or holes of different forms. The phenomena of diffraction were first noted and commented on by Grimaldi, of the Jesuits' college of Bologna, in 1665. Sir Isaac Newton investigated the subject, and explained it further. About 1819 Fresnel demonstrated that interference was result of the wave motion of light and that sound waves are similarly affected. Joseph von Fraunhofer, of Munich, made a most exhaustive study of diffraction, and classified the lines of the spectrum, which became known as "Fraunhofer's lines." He invented the diffraction grating about 1821, for exhibiting the lines and forming the spectrum. This grating, as at first made, was a glass surface, smoothed as perfectly as possible, and covered with a thin film of gold-leaf, lampblack, gelatine, or the like. Through this film were scratched or ruled parallel lines, constituting minute apertures for light. In order that these lines might be made very fine, close, and accurate, the dividing engine (q.v.) was devised. With this were ruled a great many thousand lines to

the inch. These lines must be exactly the same distance apart to be valuable. When the light was allowed to pass through the rulings or slits of this transmission grating to a screen, the light on the screen was divided or dispersed, appearing in bands, and forming a spectrum. It was found that to obtain a satisfactory spectrum, a grating of 15,000 to 20,000 lines to the inch was desirable, and even very much finer rulings have been demanded and manufactured. In order to use gratings ruled on plane surfaces for spectroscopic purposes, it is necessary to employ a telescope and collimator. After a time the reflecting grating was invented. In this a surface of speculum metal was ruled, and this had some advantages over glass. Prof. Henry A. Rowland, of Baltimore, has achieved distinction in the production of improved diffraction gratings, making a reflecting grating with a concave surface, that can be used without lenses. The diffraction grating has been much used in studying the solar spectrum. See LIGHT; SPECTRUM; SPECTROSCOPE.

For further information as to diffraction gratings, see 'Gratings in Theory and Practice,' in 'Astronomy and Astro-Physics,' Vol. XII., 1893. For information as to diffraction, consult Preston, 'Theory of Light' (London 1895).

**Diffusion**, in physics, is the gradual and spontaneous molecular mixing of two fluids in contact. It takes place regardless of or in opposition to gravitation, and is due to the mutual attraction of molecules. Diffusion is most common between gases, and the lighter the gas the faster does diffusion take place. It also occurs between viscous substances and, in some cases, between solids. A common experiment for exhibiting the diffusion of gases is to place in contact vessels of hydrogen and oxygen. After a time it is found that the contents of both vessels are alike—a homogeneous mixture of the two gases. If the heavier gas is placed below the lighter, the result is the same, demonstrating the fact that gravity does not check the result. If chlorine is one of the gases used, its color will enable the eye to follow the diffusion. If a porous body is placed between the vessels, the rate of diffusion can be measured. This fact is taken advantage of in the construction of the diffusimeter, invented by Thomas Graham. This consists essentially of a tube containing a gas, the lower and open end of the tube being dipped in mercury, while the upper end is closed with a porous plug. The rise of the mercury in the tube serves to measure the diffusion of the gas through the plug. Another method of testing diffusion is to fill a diffusion-tube with hydrogen and immerse the lower and open end in water, while the upper end is closed with the porous plug. Diffusion then takes place both ways, into the water and into the air.

Alcohol and water afford one of the readiest means of testing the diffusion of liquids. They will diffuse the same as gases, regardless of gravity. Stirring the two hastens the diffusion, because it brings a larger surface of one liquid against the other. At the same time the action is not a mixing in the ordinary sense, but a mixing of the molecules, forming a liquid that is of like proportions throughout when the diffusion is complete. If water in a glass vessel be colored with a few drops of litmus solution, and sulphuric acid be introduced through a tube to the bottom of the vessel, care being taken not

## DIGAMMA — DIGESTANTS

to disturb the water, the diffusion may be observed visually. The water, which is blueed by the litmus, turns from blue to red as the diffusion of the sulphuric acid progresses. Some manufacturers of sugar have used the principle of diffusion for extracting cane-juice, and also for making an extract from beet-root. Hot water is applied to the cut cane, and diffusion withdraws a large part of the juice, securing the sugar. Surgeons have also utilized diffusion to cause a liquid to pass through a membrane or tissue of the body. It is the principle of diffusion of liquids that enables the druggist to compound the several items of a prescription. The uniform strength of his solutions and extracts is also largely dependent upon diffusion. If it were not for this, several fluids in a vessel would tend to arrange themselves in layers according to gravity, as is the case with water and oil, which do not diffuse together. Substances in solution also diffuse, following Fourier's law of the diffusion of heat. As the temperature rises the rate of diffusion increases. Since the rate of diffusion of different solutions and liquids varies, it becomes possible to separate component substances in solution, by taking advantage of the difference in rate of diffusion of each component. It has been demonstrated that some solids diffuse, though with extreme slowness. Lead placed upon gold for a period of years will be found to contain gold to a slight distance above the point of contact.

For a fuller understanding of the diffusion of gases, see KINETIC THEORY. Compare also OSMOSIS, which is, practically, diffusion taking place through a membrane.

**Digamma**, in the Greek language. In addition to the smooth and rough breathings, the ancient Greek language had another, which remained longest among the Æolians. This is most commonly called, from the appearance of the character used to denote it, which resembled our letter F, a *digamma*, that is, double F. It was a true consonant, and appears to have had the force of *f* or *v* or our *w*. It was attached to several words, which, in the more familiar dialect, had the smooth or rough breathing. Though the whole doctrine of the digamma is obscure, yet it is found in early Greek words, especially in Homer.

**Digby, Sir Everard**, English conspirator: b. 16 May 1578; d. 30 Jan. 1606. He enjoyed some consideration at the court of Elizabeth and James I., by whom he was knighted. Being gained over by Thomas Tresham to the extreme Catholic party, he was induced to give £1500 toward the expenses for the execution of the gunpowder plot. On the discovery of the conspiracy he was tried and hanged in 1606.

**Digby, Sir Kenelm**, English physical philosopher: b. Gothurst, Buckinghamshire, 11 July 1603; d. London 11 June 1665. His great-grandfather bore arms for Henry VII. on Bosworth field; his father, Sir Everard (q.v.) died on the scaffold as one of the leading Catholic gentry implicated in the gunpowder plot, 1606. Kenelm, then 3 years old, was educated as a Protestant, but at the age of 33 returned to the faith of his fathers. After completing his academic studies at Oxford he went on his travels through France, Spain, and Italy; in 1628 equipped at his own cost a squadron against the Algerine corsairs, and incidentally defeated a

Venetian force off Scanderoon. Returning home, 1638, he was thrown into prison as a royalist and not liberated till 1643, when he retired to France; there he was in high favor with the court and with men of learning and philosophers, among them Descartes. At the overthrow of the royalist cause he returned to England but was banished under pain of death by the Parliament. He then for a time served the French king in various embassies, but under the protectorate came back to England and was admitted to the intimate friendship of Cromwell. He was one of the founders of the London Royal Society. His works on physical philosophy, on natural science and on metaphysical subjects possess now only the interest of curiosity; among them are a 'Treatise on the Nature of Bodies,' 'Peripatetic Institutions,' 'Treatise on the Soul,' etc. On religious matters he wrote many books, among them 'A Conference About a Choice of Religion,' and 'Letters' on the same subject. His brief critique of Sir Thomas Browne's 'Religio Medici' gives a specimen of his style of argumentation. He was all his life an inquirer into occultism and wrote a book on 'The Cure of Wounds by the Power of Sympathy;' he hoped also to discover a means of conserving into old age the extraordinary personal beauty of his wife, and invented cosmetics to that end.

**Digby, Kenelm Henry**, English antiquarian; b. 1800; d. London 22 March 1880. He was graduated from Trinity College, Cambridge, in 1819, and in 1822 published 'The Broad Stone of Honor,' "that noble manual for gentlemen," as Julius Hare called it, "that volume which, had I a son, I would place in his hands, charging him to love it next to his Bible." It was much altered in the 1828 and subsequent editions (the latest 1877), its author having meanwhile become a Roman Catholic. Among his other works may be named 'Mores Catholici, or Ages of Faith' (1831-40).

**Digby, William**, English journalist and East India merchant: b. Wisbech, Cambridgeshire, 1 May 1849. Entering journalism he was successively engaged in newspaper work in England 1868-71; in Ceylon 1871-6; in Madras 1877-9; and again in England 1880-2. Since 1888 he has been an East India merchant in London. He has published: 'Forty Years' Citizen Life in Ceylon'; 'The Famine Campaign in Southern India' (1876-8); 'History of the Newspaper Press of India, Ceylon, and the Far East'; 'Indian Problems for English Consideration'; 'Nepal and India'; 'Condemned Unheard'; 'Indian Economics'; 'Prosperous British India' (1901); 'Natural Law in Terrestrial Phenomena'; etc.

**Digby**, Nova Scotia, on Saint Mary's Bay. A United States consular agent is stationed here. The town is noted for its curing of a variety of small herrings or pilchards. Pop. 1,150.

**Di'gest**. See CIVIL LAW.

**Digestants**, remedies that aid digestion, and which may include such agencies as exercise, sunlight, and pleasurable emotions, although the term is usually restricted to the drug agents that modify the secretions found in the stomach and intestines. The most important of these drug agencies that are employed for the



## DIGESTER — DIGESTION

purpose of stimulating the appetite are the bitters, such as cinchona, columba, quassia, nux vomica; the carminatives, such as cinnamon, cloves, ginger, cardamom, capsicum, peppermint; alcoholic mixtures, such as the wines, brandy, whiskey, the cordials; the digestive ferments, such as diastase, pepsin, pancreatin; and the weak alkalies and weak hydrochloric acid.

**Digester**, a closed boiler in which a temperature above the boiling point can be obtained, the hot water and steam disintegrating or digesting the substance treated. The invention of the digester is credited to Denis Papin, a French scientist. He noted that anything boiled in an open vessel was not subjected to a heat above 212° F., as the water went off into steam at that temperature, and was lost. Accordingly he constructed a boiler with a closed top, to retain the steam, and succeeded in securing a temperature of 400° F., which served to readily digest bones. This digester came into use for the manufacture of soups and gelatines from bones that had been previously wasted or thrown to the dogs.

Within recent years the digester has found a place in a number of industries. The lard or grease tank of a slaughter-house is a digester. In some American cities digesters have been employed to receive garbage and secure a product of some value from the refuse. Tannin is extracted from nutgalls by a digester, in which the material is saturated with ether.

The digester has found its most extensive use, however, in paper-making. The wood, which is abraded by grinders from the log is introduced in a form resembling fine sawdust to the digester, and comes out pulped, ready to be rolled into paper. Sulphite digester is the common name for these mechanisms owing to the fact that a bisulphite solution is employed in the process of digesting. This serves as a solvent, but being acid it attacks the iron or steel of which the digester is constructed. To protect the iron shell various linings are employed. The "Non Antem" digester employs a lining made of a continuous sheet of lead placed against the inner sides of the shell, and held in place by two courses of acid-proof brick. The Mitscherlich digester is lined with acid-proof brick laid in Portland cement. The Graham digester is made of sheets of boiler plate, with the lead lining soldered on before bending. The Partington digester is made spherical, so that the lead lining tends to maintain its place from its form; the lead is also burned to the iron. Pusey & Jones build a digester of welded steel, with double shells and no lining. The Schenck digester is also unlined, being made of deoxidized bronze, and in both of these last-named the erosion is claimed to be very slight.

Most sulphite digesters are built in the form of an upright cylinder, with one or more man-holes at the top, through which the ground wood is introduced. Steam is admitted by coils, and a high temperature maintained for about eight hours. When properly cooked, the liquid is run off and the digested material withdrawn by manholes in the bottom.

**Digestion**, the change which food undergoes in order to prepare it for the nutrition of the animal frame. It is carried on in the higher animals in the digestive system. In some of the lowest forms of animal life (*amœbæ*) which

have no special organs, particles of food are drawn into the body and digested. In higher organisms there is a simple pouch which leads inward from the centre of the cluster of ten-

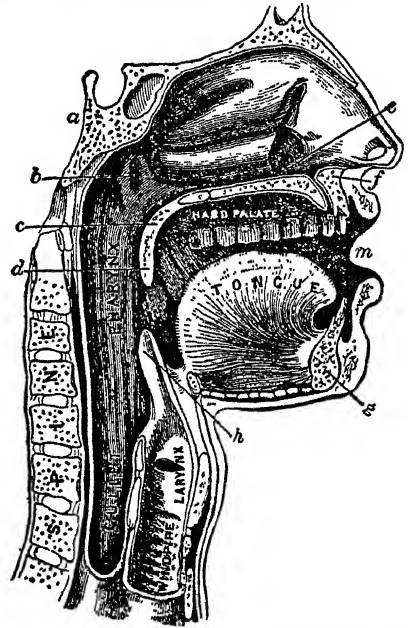


FIG. 1.—Section Through Mouth, Nose, etc.—a, sphenoid bone; b, Eustachian tube; c, soft palate; d, uvula; e, nasal passage; f, upper jaw; g, lower jaw; h, epiglottis; m, mouth.

tacles; into this fish and other food are drawn and digested, while the undigested parts are afterward voided through the same aperture by which they entered. In still higher organisms, man himself included, this simple pouch is changed into a complex and greatly elongated tube, which is provided with one aperture (the mouth) by which food enters, and another aperture (the anus) through which undigested matter leaves the body. The mouth in most animals is provided with hard tissues—teeth, beaks—for the subdivision of food before it is swallowed. Vegetable feeders, eating tough grains, roots, and fibres, have large molar or grinding teeth, while the carnivora have these same teeth modified so as to present a cutting edge, with which and their pointed canines meat is torn and cut into pieces, which are then swallowed. Below, the cavity of the mouth passes into the gullet or oesophagus, and in front of this tube runs the windpipe. Food will pass through the pharynx, or the interior of the throat, into the gullet; and air, during respiration, passes through the pharynx on into the larynx and windpipe; a valve called the epiglottis partly closes the aperture of the larynx.

The gullet or oesophagus is a long tube passing from the pharynx to the stomach. Its mucous coat is loaded with very large glands which secrete a quantity of very viscid mucus. The stomach itself is a greatly dilated part of the digestive system. It may be said to consist of two parts, even in the human subject; a more complex arrangement is found in many animals, such as the ruminants. The large dilated portion into which the gullet opens is termed cardiac, and the opening the cardiac or



## DIGESTION

oesophageal opening. The mucous membrane, which,

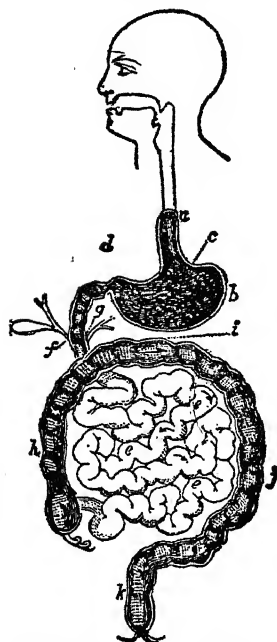


FIG. 2.—Alimentary Canal.—a, oesophagegus; b, stomach; c, cardiac orifice; d, pylorus; e, small intestine; f, biliary duct; g, pancreatic duct; h, ascending colon; i, transverse colon; j, descending colon; k, rectum.

abdominal walls. This membrane is called the peritoneum. The small intestine is somewhat arbitrarily divided into three portions—the upper (duodenum), the middle (jejunum), and the lower (ileum). The mucous coat contains glands very like the pyloric glands of the stomach, called Lieberkühn's follicles. They secrete the intestinal juice. In the duodenum one finds in addition highly branched glands called Brunner's. In both the mucous and sub-mucous coats, and generally involving both layers, are found masses of tissue—lymphoid—similar to that found in a lymphatic gland. Their function is probably connected with the blood and the blood corpuscles. Collections of these solitary glands, forming oblong patches about two inches long, are called Peyer's patches. In addition to the follicles of Lieberkühn and the glands of Brunner, there are the liver and the pancreas, which pour their digestive juices into the small intestine. The bile, which is the secretion of the liver, is formed continually by that organ, but the amount thus formed is influenced by the kind and quantity of food taken. The bile is to be looked upon not only as a digestive juice, but as a drain or channel of excretion, whereby effete and useless matter is removed from the body. The pancreas is very similar in structure to a salivary gland. It secretes the pancreatic juice which pours with the bile into the digestive system. The mucous membrane of the small intestine contains, in addition, little projections called villi. These are

whole is lined with in the empty stomach, is thrown into projecting folds or rugæ, but these folds are effaced when the organ is distended with food. In the membrane are innumerable glands which secrete the digestive juices of the stomach. The gastric juice is acid, and the chief acid secreted is hydrochloric acid. The substance called pepsin, which is necessary for digestion, is secreted by the whole of the glands.

The food now called the chyme passes into the small intestine, a tube about 20 feet long. This tube, besides the muscular and mucous coats, possesses an external coat of loose fibrous tissue covered by a single layer of flat cells. This coat is prolonged into and helps to form the mesentery, a membrane connecting the intestine with the

important absorbents. This property they share with the whole of the digestive system through any part of which, and especially through the walls of the stomach and small intestine, digested matter passes into the numerous blood capillaries which form everywhere a dense network. The villi are peculiar, for each one contains in addition to blood vessels a small lymph vessel or lacteal. Nearly all the fat absorbed by the digestive system is taken up by the little cells of the villi, and passes on into the lacteals and thence to the blood.

The unabsorbed food, mixed with the various secretions we have mentioned, now passes into the large intestine, where both digestion and absorption go on, though to a less extent. The large intestine is only five feet in length, but its girth is much greater than that of the small intestine. It commences with the cæcum, a dilated part, into which passes a little blind canal (the vermiform appendix) a large and important structure in some animals. The large intestine ascends on the right side (ascending colon), crosses over to the left side (transverse colon) and descends again (descending colon), and makes a bend (sigmoid flexure), and finally terminates in a somewhat enlarged portion (rectum). The mucous membrane of the large intestine differs from that of the small intestine in containing no villi or Brunner's glands. Lieberkühn's and solitary glands are present, but the aggregation of the latter into Peyer's patches is nowhere to be found.

When food is taken into the mouth it is at once swallowed, unless it is in a solid form. In this case it is chewed into a convenient size for swallowing, for which purpose it is, in addition, mixed with the viscid saliva and juices of the mouth. Many animals can hardly be said to masticate; such are the carnivora (dog, cat, etc.), and they are not provided with grinding teeth. In most animals living on vegetable food large flat grinding molars are found. In these animals, not only is the food finely divided in the mouth, but the food, largely consisting of starch, is partially digested by the saliva. During mastication the food would nat-

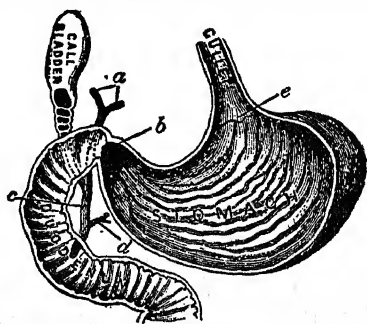


FIG. 3.—Section of the Stomach.—a, ducts of liver; b, pylorus; c, bile duct; d, pancreatic duct; e, cardiac orifice.

urally tend to escape from between the grinding surfaces of the teeth, and would collect within the mouth and outside the gums. This is prevented by the muscles placed in the substance of the cheeks and lips.

As a result of mastication, the food is gathered in the form of a round moist bolus on the upper surface of the tongue. It is now ready to be swallowed. In the first place, it is

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pushed backward by the tongue and seized by muscles, many of which are attached to the hyoid bone. According to the most recent investigation, the bolus is propelled with great rapidity through the pharynx and gullet into the stomach. Following the propulsion of the food downward there is a wave of contraction, which, commencing in the pharynx travels comparatively slowly downward through the gullet. It is seen then that swallowing is not due to the falling of liquids down the throat. A horse drinks "up-hill," and the jugglers, or indeed anyone can drink or swallow with the head vertically downward. When the food has reached the back of the mouth, swallowing occurs irrespective of the action of the will.

There is a possibility that during swallowing the food may go the wrong way—that is, it may pass into the larynx and windpipe. It is prevented from passing into it by the elevation of the larynx which pushes its aperture against

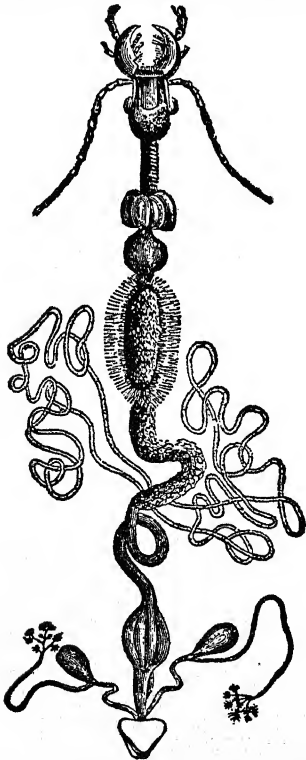


Fig. 4.—Digestive organs of Coleoptera.

and under the back of the tongue, which at the same time is pushed backward. In addition, there is a valve called the epiglottis, which is pushed down over the larynx by the movement just described and by muscular fibres which act upon it for that especial purpose. The walls of the stomach and intestines are, like the gullet, provided with muscular fibre. An external layer passes in the length of the gut, and within this is a circular layer. These muscles contract slowly on stimulation, and are outside the domain of voluntary action. During the digestion they contract peristaltically, urging the food toward the rectum. The peristaltic waves may begin in any part of the gut and pass slowly downward followed at varying intervals by

other waves. Probably what is called antiperistaltic waves may occasionally occur, tending to bring the food back toward the mouth, for bilious matter is frequently vomited, the bile having in all probability passed upward into the stomach by antiperistalsis from the duodenum.

Eruclatations are frequently caused by antiperistalsis and by a movement of this kind food is brought back into the mouth for further chewing in the ruminants (sheep, oxen, etc.). The act of vomiting is a reflex nervous act. It can be excited by stimulating the branches of the vagus nerve, as when indigestible and irritative food is taken, or emetics are administered. By tickling the back of the throat with a feather, the glossopharyngeal nerve is stimulated and vomiting may readily be produced. It is of frequent occurrence in painful irritations of the uterine nerves in pregnancy, of the nerves of the liver and kidneys during the passage of a hepatic or renal stone, or indeed when irritation of any sensory nerves takes place. Cases in which irritating or poisonous substances are swallowed are so frequent that everyone should be aware that a large quantity of hot liquid, especially if it contains much salt or some mustard, forms a safe and speedy emetic. Ice is a valuable sedative, and often prevents vomiting.

In many animals, such as the sheep, ox, and camel, the stomach consists of several cavities communicating with one another. In the ox and sheep the cardiac and the pyloric portions are each subdivided into two compartments. The cardiac part consists of a very dilated cavity, the paunch (rumen), into which the food is passed as soon as swallowed. In addition there is a smaller part, the reticulum (honeycomb) so called from the folds of lining mucous membrane which intersects, forming a reticulum. The pyloric half is divided into two parts. The psalterium (maniples), so called from the lamellated appearance of its mucous membrane, communicates with the last division, the rennet stomach (abomasum). Fluid passes either into the first, second, or third part of the stomach, and thence on into the fourth. Solid matter, such as grass, roots, etc., passes either into the paunch or reticulum. This is mixed with the saliva swallowed with it and in addition it is mixed with juices formed by the mucous membrane of these cavities. When the animal has finished feeding, it lies down and rumination commences. Due in part to the contraction of the abdominal muscles and diaphragm, the food is propelled in the form of rounded pellets from the paunch and reticulum up into the mouth. The pellets are there thoroughly masticated, and are returned in a pulpy condition to the stomach. Now the food passes into the psalterium, and into the rennet stomach. Hence the consistency of the food determines into which part of the stomach it passes.

In the bird some interesting modifications in the structure of the alimentary canal are seen. The gullet at about the middle of its course is provided with a pouch or crop. Into this the food passes, and is bathed by a secretion formed by its glands. It is then propelled onward into a dilated cavity, the proventriculus, and is acted on by digestive juices. Thence it passes into the gizzard. This cavity is provided with muscular walls of enormous thickness in the case of birds that are vegetable feeders. It is lined by thick and corneous epithelium, and in

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its interior are generally found pieces of stone, chalk, etc. The gizzard is a powerful mill, which grinds the food into a soft pulp, upon which digestive juices can readily act. See BIRNS.

The most essential change which food undergoes in digestion is one of solution. Albumen, starch, fat, and other food-stuffs are insoluble in the circulating fluids of the body, and injected into the blood they would block up the smaller blood vessels. During digestion these pass either into nearly allied chemical substances which are readily dissolved in water, or in the case of fat partly into a soluble soap and partly into a state of microscopically minute subdivision. It is not sufficient, however, to have a soluble food-stuff in order that it may be absorbed and used by the body. Cane (table) sugar is soluble in water, but it is of no use as cane-sugar to the body. If injected into the blood vessels it is at once secreted by the kidneys. During digestion it is converted into another sugarless soluble, but in a form which can be used by the economy.

The digestion of food is brought about by the action of the saliva, the gastric, pancreatic, intestinal and other juices. These are mixed with the finely divided food by the movements of the alimentary canal. The digestive juices are in all cases secreted by the microscopic cells which line the various glands opening into the digestive system. The digestive ferments are not whole cells, they are the products of cells. They are not the broken-down, useless substances, such as carbonic acid, water, etc., which all cells give out, and which an animal like man excretes. They consist of a very complex active matter, of which we know almost nothing, and which we class with other substances of which we know little more, under the head albuminoids.

When food is passed into the stomach, secretion occurs. This, too, may result from mechanical irritation, as when through an opening (fistula) the mucous membrane is brushed with a feather. In all cases the stomach, pale before, becomes suffused with blood, and the gastric juice is poured out. The flow of the intestinal juice, the pancreatic juice, and bile all follow the stimulation of the mucous membrane, and in all cases the blood vessels enlarge so as to give the cells a good supply of food, though, as we have seen, they themselves actually pass into a condition of activity as a result of the influence of special secreting nerves. Foods belong to four classes: (1) Proteids—albumens, globulins, etc.; for example, the white of egg, the chief constituent of meat, the gluten of bread. (2) Carbohydrates—starches, sugars, gums; for example, potato-starch, cane- or grape-sugar. (3) Fats and oils; for example, suet, marrow, olive oil. (4) Minerals; for example, water, table salt, iron, phosphates.

Some few substances are absorbed without being digested at all; they do not need to be. Such are water and the minerals, though even many of these undergo some change. Grape-sugar is absorbed and probably proteids too are often absorbed to some extent at least. Fat is profoundly modified during digestion, though not as the result of any digesting ferment. The saliva, of which about 30 ounces are secreted during the 24 hours, contains a ferment termed ptyalin, which is capable of turning a starch into a soluble sugar called grape-sugar, or, ac-

cording to other observers, into another soluble sugar termed maltose. The ptyalin may be extracted from the saliva or from the salivary glands themselves. It does not appear to be much exhausted during its activity and has the general characters of unorganized ferments. The saliva is alkaline, and the starchy food is no doubt partly converted into sugar during its sojourn in the mouth and gullet by its action. When the food has reached the stomach and the acid gastric juice has mixed with it, the saliva is unable to act and is probably killed. Any digested starch is subsequently converted into sugar when the food reaches the small intestine by the pancreatic juice.

When the food reaches the stomach it causes a reflex secretion of gastric juice. This is but slowly produced when insipid heavy food, such as coagulated white of egg, boiled meat, sago, etc., is eaten, but flows readily when soups, broths, and fluids containing salts and extractions in abundance are taken. Thus we have a scientific reason for beginning a dinner with soup, preserving the *pièce de résistance* until the stomach has secreted gastric juice for its digestion. The gastric juice, several pounds of which are secreted daily, is acid in reaction containing free hydrochloric acid. Lactic and butyric acids form during the progress of digestion.

Within the stomach, and capable of being readily extracted from the stomach of a calf, is a ferment called the milk-coagulating ferment (rennet). This causes milk to coagulate and form a clot or curd. It subsequently contracts and squeezes out some fluid termed the whey. It is difficult to assign any use to this ferment, for the acid of the gastric juice would of itself cause the milk to curdle. Still more difficult is it to explain the existence of a similar ferment in the pancreatic juice, for we cannot suppose that any milk can even pass through the stomach to be subjected to its action. The milk, indeed, often forms dense clots which cannot afterward be digested, and which cause considerable gastric irritation. Milk is frequently found to disagree with some stomachs; but even in such cases it may often be sipped with impunity. In this case the formation of large clots is prevented. Lime water causes the milk to coagulate in small soft clots.

Within the small intestine most of the food undigested by the stomach (q.v.) is rendered fit for absorption. This takes place through the tissue of the mucous membrane; much of the sugar and peptones find their way into capillary blood vessels. Absorbed products and notably fat globules pass into the lacteals, and thence into the blood, circulating through the veins at the root of the neck. The contents of the lacteals during absorption are called chyle. The contents of the small intestine pass into the large intestine, where digestion occurs to a very slight extent. Absorption is, however, more rapid, and the contents become far more solid as they pass toward the rectum, due to the deprivation of water and soluble substances. The absorptive power of the large intestine is important to remember; for injections per rectum of liquid food, especially if it has already been artificially digested, may sustain life for long periods.

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## DIGGINGS — DIGITALIS

**Diggings**, a colloquial expression among miners in North America, Australia, South Africa, etc., the term designating the places from which gold is procured by means of surface excavations. Proceeding from the mining regions this appellation has become an everyday expression in referring to a region, locality, or place, as:

"She won't be taken with a cold chill when she realizes what is being done in these diggings?" Dickens, 'Martin Chuzzlewit.'

**Diggs, Annie L.**, American author and librarian: b. London, Ontario, Canada, 1853. She was the first woman to lead a delegation at a national political convention, serving as chairman of the delegation from the District of Columbia, at the National People's Party Convention, Omaha, 1892. She is a temperance worker and political speaker, and president of the Kansas State Woman Suffrage Association, and she has been State librarian of Kansas since 1898. She is the author of 'Little Brown Brothers,' and many short stories.

**Dighton Rock**, a boulder of "greenstone" (in fact, bluish-gray), in Berkley, Bristol County, Mass., opposite Dighton, the landing-place for it; on the east shore of the Taunton River, about 10 feet from low-water mark, and covered two or three feet deep at each flood tide. It is 11½ feet long and about 5 feet high, with a flat face toward the river, once covered with inscribed characters varying from scratches to one third of an inch deep, not chiseled, but "pecked" in. For many years the stream of visitors, unchecked by any authority, have so often scrubbed off the tidal deposits of dirt with brooms and water to see the characters more plainly, that most of the latter are effaced and the whole past effective study. From old drawings, however, and comparison with similar petroglyphs elsewhere, there is no doubt it is Indian; Schoolcraft says, in the symbolic character of the Kekeewin. (See Garrick Mallery in annual report of the Bureau of Ethnology, 1888-9, pp. 85-6, 762-4; from Dr. Hoffman's examination of 1886.) Enthusiasts at various times have made wonderful interpretations of it. Rafn of Copenhagen found the name of Thorfinn on the drawing sent him (see his correspondence with the Rhode Island Historical Society 1830-4, in 'Antiquitates Americanae,' Copenhagen, 1837), and thought it a record of the Vinland settlement; an Orientalist deciphered "melek" (king), and considered it Phœnician, and another believed it Scythian. Many drawings have been made of it since the first by Samuel Danforth in 1680, and a second by Cotton Mather in 1712; for which, and a picture of the rock *in situ*, see Rafn as above, and for the drawings, the report above cited.

**Digit**, in arithmetic, usually signifies any one of the 10 numerals, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, though zero is sometimes not regarded as a digit. The word comes from *digitus*, a finger; thus indicating the humble means originally employed in computations. Digit is also a measure of a finger's breadth equal to three fourths of an inch.

Digit, in astronomy, is the measure by which we estimate the quantity of an eclipse. The diameter of the sun or moon's disk is conceived to be divided into 12 equal parts, called digits;

and according to the number of those parts or digits which are obscured, so many digits are said to be eclipsed. When the luminary is wholly covered, the digits eclipsed are precisely 12; and when it is more than covered, as is frequently the case in lunar eclipses, then more than 12 digits are said to be eclipsed.

**Digitalin**, dij'-i-ta-lin, various substances obtained from the leaves and seeds of the common foxglove (*Digitalis purpurea*), some of them being deadly poisons, but of great medicinal value, while others are almost inactive or harmless. Of these the earliest extracted was Homolle's digitalin, prepared from the leaves by the action of alcohol, ether, and lead oxide. It is a white, bitter, partially crystalline body without smell, soluble in alcohol, but not in water or ether, and has been used in medicine. Another digitalin was obtained by Walz by treating that of Homolle with ether and water; it is yellow, amorphous, soluble in water, and very powerful in its action. Another chemist, Nativelle, obtained from the leaves two crystalline bodies, known as digitalin and digitin, and an amorphous one called digitalein. Digitalin, prepared by various processes, and probably not chemically pure, is employed in medicine, being useful in stimulating the action of a weak heart, and effective also in removing dropsical fluid by its action on the kidneys; but it is apt to derange the stomach and bowels, cause loss of appetite, etc.

**Digitalis**, dij'-i-tă-lis, a name given to the leaves of the plant *Digitalis purpurea* (see FOXGLOVE), of the second year's growth. This is a biennial herb which is largely cultivated for ornament. It is about two to five feet high, with large succulent leaves and tubular urn-shaped purple flowers growing in a raceme. It is a native of southern and central Europe, and is extensively cultivated throughout the world, although the cultivated leaves are not as serviceable as those of the wild plant. The leaves, which lose on drying about 75 per cent in weight, are mostly obtained from the wild plants growing in the mountainous regions when two thirds of the flowers are expanded. The leaves should not be kept more than one year, as the quality deteriorates very rapidly. The active principles in the digitalis leaves consist of four or five glycosides: digitoxin, digitophyllin, digitalin, digitalein, and digitonin. The seeds also contain large amounts of active glycosides. The action of digitalis on the body is complex. It is primarily a local irritant causing secondary paralysis of the sensory nerve-endings. It is bitter to the taste, followed by burning and swelling of the mucous membrane. It is an irritant to the intestines, where it may cause nausea and vomiting. After absorption the chief action of the drug is on the central nervous system, the heart, and the blood vessels. The action on the nervous system is of secondary value to the heart activities, although there is distinct stimulation throughout. The action of the drug on the heart-muscle is the most important property possessed by digitalis, both pharmacologically and therapeutically. Here, by reason of the complicated physiology of the heart action, the differing effects of digitalis on this organ are somewhat difficult to comprehend. Digitalis stimulates primarily the muscular fibres of the heart. It stimulates the cardiac nervous gang-

lia; and it stimulates, and then paralyzes, the cardiac inhibitory nerve, the pneumogastric. Thus the normal heart, under the action of small doses of digitalis, is at first made to beat somewhat more strongly and rapidly; but as soon as its action upon the pneumogastric becomes manifest, in larger and increasing doses, the heart action becomes more powerful and is somewhat slowed; and in full medicinal doses, frequently used in medicine when the effects of digitalis are desired, the action of the heart is much stronger and considerably slowed. The blood-pressure is high, and the arteries are contracted. If, however, the use of digitalis is pushed beyond this point, its action as a paralyzant of the pneumogastric begins to be evident. By reason of this loss of the inhibitory action of the pneumogastric, the heart action at first is stronger, and the beat becomes more rapid. If still further toxic doses are given, the heart runs away, as it were. It beats very rapidly, irregularly, and with increasingly weakened force, until it finally stops exhausted. Digitalis also increases the secretion of urine; it raises the pressure of the blood vessels, and increases the amount of blood in all the organs of the body, including the heart itself. It is thus one of the great cardiac tonics, when used within physiological limits, and is indicated in most cases of heart disease where there is malnutrition caused by the dilatation of the chamber or a leakage of the valves.

**Digitaria**, a genus of grasses, commonly called finger-grasses, now classed under the genus *Panicum*. See FINGER-GRASS.

**Digitigra'da**, a group of mammals in the obsolete system of Cuvier, comprising those like the dogs, cats, civets, weasels, rodents, etc., which have the metacarpals and metatarsals greatly lengthened, and the foot otherwise modified, so as to lift the heel off the ground. The animal consequently walks upon its toes (digits), an adaptation to the requirements of captivity and speed. This form of foot appears very early in the history of the mammalian class, but has reached its highest development in more modern forms. The opposite condition, in which the whole sole of the foot rests upon the ground, as in bears, man, and others, is called "plantigrade"; but some animals, as those of the raccoon family, are intermediate between plantigrade and digitigrade in their method of standing and walking. The term no longer expresses a scientific classification.

**Dijon**, dē-zhōn (ancient DIBIO), France, chief town in the department of Côte-d'Or, and formerly capital of the old duchy of Burgundy. It is 196 miles southeast of Paris. Its importance as a railway centre has rendered it of consequence in the inner line of French defenses. Pop. (1901) 70,428.

**Dika**, dē'ka, a vegetable fat obtained from the seed of a West African tree, *Irvingia barteri*, used in making fine soaps. It resembles cacao-butter, and makes very hard soaps. The tree belongs to the *Simarubaceæ*, and has alternate, entire leaves and drupaceous fruits.

**Dikamali**, dik-a-māl'i, a resin exuding from Indian trees of the genus *Gardenia*, especially *G. lucida* and *G. gummifera*, a solution of which is used to dress wounds and open sores. These trees belong to the order *Cinchonaceæ*.

**Dike**, Samuel Warren, American reformer: b. Thompson, Conn., 13 Feb. 1839. He was graduated from Williams College in 1863; and from Andover Theological Seminary in 1866. He was subsequently ordained as a Congregational minister. He was the founder of the Divorce Reform League, now known as the National League for the Protection of the Family, and has been its corresponding secretary from the first. He also established the home department of the Sunday School. He has written numerous papers for periodicals on marriage, divorce, the family, etc.

**Dī'ke**, in Grecian mythology, the avenger of wrong, and the rewarder of virtue. She is the daughter of Zeus and Themis, and is considered one of the Horæ.

**Dike**, or **Dyke**, a word variously used to represent a ditch or trench, and also an embankment, rampart, or wall. It is specially applied to an embankment raised to oppose the incursions of the sea or of a river, the dikes of Holland being notable examples of works of this kind. Owing to the possibility of great loss of property and of life, the punishment of all neglect or for malicious mischief to dikes is extremely severe. The dikes which protect the Netherlands and the German coasts of the North Sea go back to the old Roman times. Apparently even before the Romans appeared the Batavians at the mouth of the Rhine protected themselves by dikes. Drusus after the conquest of Holland, 10 B.C., built an elaborate system of artificial canals and dikes. Pliny the Elder gives interesting descriptions of the artificial hills which were erected as places of refuge during the floods.

Among the provinces in North and South Holland which have been protected by dikes may be mentioned the Province of Hanover, 618 miles, protecting 770,000 acres of marsh land. On the left bank of the Oder River there is a dike which protects more than 170,000 acres of land. The dike at the delta of the Vistula protects 134,000 acres of land. On the Lower Rhine, between the Weser and Holland are 115,000 acres protected by dikes. Along the Loire River are 280 miles protecting 230,000 acres. Along the Po there are 310 miles protecting 850,000 acres. In England there are 1,750,000 acres protected by dikes. Many of the dikes of Holland are raised 40 feet above high-water mark and are wide enough at the top for a general roadway or canal, sometimes for both.

In the United States the term dike is almost wholly restricted to the structures of more or less permanence built in various ways in the bed of a stream to regulate its flow, narrow the low water cross section, concentrate the current, increase its local scouring effect and thereby deepen the river channel. The earthen embankments designed to restrain the flood waters are called levees. The most notable examples are found along the Mississippi River. These levees are placed some little distance back from the river, and according to the local conditions vary in height from 2 or 3 feet to over 20 feet. Levee building began many years ago along the lower part of the river and it has been carried on practically continuously ever since. Up to June 1900 the United States had



expended more than \$15,000,000, and the various levee boards had expended between 1882 and 1900 more than \$22,000,000. The length of the levee lines along the Mississippi River in 1900 was about 1,300 miles, and the area protected from overflow about 27,000 square miles. In the existing levees there were about 140,000,000 cubic yards of earth, and to complete the system and make the levees safe against the maximum possible flood would require about 120,000,000 cubic yards in addition, which it was estimated would cost about \$20,000,000. See RESERVOIRS.

**Dike.** In geology, a dike is any elongated and relatively narrow body of igneous rock that was forced while molten into a fissure and hardened there. The rocks cut by the fissure may be either sedimentary or igneous, and a dike may be from a few inches to a hundred feet thick. Dike rocks, especially in thin dikes, have usually a compact texture due to the quick cooling. Quartz, porphyry, and basalt are the commonest dike rocks. Dikes are to be distinguished from veins which are fissures filled with minerals (quartz, calcite, etc.) deposited from solution; but some dikes of rocks containing much silica were deposited from igneous solutions containing the vapor of water, hydrochloric acid, etc., and such dikes may grade insensibly into true quartz veins. Dikes are of common occurrence in all regions of volcanic action and in mountain ranges, and as all manner of chemical changes may take place along the contact of a dike with the rock it cuts, dikes are often of importance in determining ore deposits. A well-known example is the relation of the iron ore bodies in many of the great mines of the Lake Superior region to the diabase dikes. So called sandstone dikes, found in California and elsewhere, represent fissures that have been filled in some way with sand. They are not true dikes. See DIABASE; ORE DEPOSITS; QUARTZ; PORPHYRY; VOLCANO.

**Dikoa**, dē-kō'a, Africa, a town in the northwestern part of Kamerun, about 25 miles south of Lake Chad. It is fortified and was at one time the residence of the ruler of the native kingdom of Bornu. Pop. 15,000 to 25,000.

**Dilatation.** See HEART-DISEASE.

**Dilem'ma** (from Gr. *dis*, twice, and *lēmma*, an assumption), in logic, an argument in which the same conclusion may be drawn from two contrary propositions. A person is said to be in a dilemma, or on "the horns of a dilemma," when each of several courses of action would lead to an unsatisfactory result. We append one of the most famous of the classical dilemmas. A young rhetorician said to an old Sophist: "Instruct me in pleading and I shall pay you when I gain a cause." The master sued for the reward, and the scholar eluded the claim by a dilemma. "If I gain my cause I shall not pay you, because the award of the judge shall be against you. If I lose it I may withhold it, as I shall not have gained a cause." The master replied: "If you gain you must pay me, because you promised to pay me when you gained a cause; if you lose you must pay me, because the judge will award it." When the case came before the judges they were unable to decide it. See LOGIC; PARADOX; SYLLOGISM.

**Dilettante**, dī-lēt-tān'tā, an Italian expression; in its original sense signifying a lover of the arts and sciences, who devotes his leisure to them as a means of amusement and gratification. The term was originally applied to a lover of Italian vocal music, and was at one time the name of a party which upheld the superiority of that class of music. In contemporary usage the word has come to mean more or less of an artistic trifter. In 1734 a number of gentlemen founded a Dilettanti Society in London, with the object of combining social intercourse with the cultivation of artistic knowledge. On the rapid accumulation of the funds, the members resolved, in 1764, to send out an expedition to collect details and drawings of the most remarkable artistic monuments of antiquity. Messrs. Chandler, Revett, Stewart, and Pars accordingly were sent to Asia Minor, and returned with the materials for the splendid work on *Ionian Antiquities*, published at the expense of the society, the first volume of which was issued in 1769; a second volume was published in 1797, and a third in 1840. Among other works published by the society are: 'Specimens of Ancient Sculpture, Egyptian, Etruscan, Greek, and Roman' (two vols. imp. folio; London 1809, 1835); the 'Unedited Antiquities of Attica' (imp. folio; London 1817); the 'Temples of Ægina and Bassæ' by C. R. Cockerell (folio; London 1860).

**Diligence**, the name originally given in French-speaking countries to a public conveyance of the nature of a stage-coach. The name was also adopted by other countries for their public carriages. The French diligence was a national vehicle going over regular routes periodically. It was a huge, heavy, cumbersome affair, upon four broad wheels which never covered a greater distance than six miles an hour. It had three compartments designed for the same number of classed passengers. Two officials accompanied the diligence on its trip; a *postillon*, who managed the horses, and a *conducteur*, who looked after the passengers and their traps.

**Dilke**, SIR CHARLES WENTWORTH, English politician: b. London 18 Feb. 1810; d. St. Petersburg, Russia, 10 May 1869. He was the son of C. W. Dilke (q.v.). One of the most active originators, as well as member of the executive committee of the Great Exhibition of 1851, he was sent in 1851 as a commissioner to the New York Industrial Exhibition, and in 1862 was one of the five royal commissioners for the second exhibition. In 1865 he was returned to Parliament for Wallingford, and in 1869 was sent to Russia as the representative of England, to the horticultural exhibition held at St. Petersburg. He was knighted in 1862.

**Dilke**, SIR CHARLES WENTWORTH, English writer and politician: b. Chelsea 4 Sept. 1843. He is a son of the preceding; was educated at Trinity Hall, Cambridge, and was shortly afterward called to the bar. His first work, 'Greater Britain,' the result of a tour round the world in 1866-7, became very popular. In 1868 he was elected M.P. for Chelsea, and he represented this constituency up to 1885. From 1880 till 1882 he was under-secretary for foreign affairs, and from 1882 till 1885 president of the local government board. After a few years'



retirement he became M.P. for Forest of Dean division of Gloucestershire in 1892. Sir Charles has played a not unimportant part in connection with various legislative measures. 'The Present Position of European Politics' (1887); 'The British Army' (1888); 'Problems of Greater Britain' (1890); and 'Imperial Defense' (with Spencer Wilkinson, 1891); 'British Empire' (1898); are among his works.

**Dilke, Emilia Frances Strong, Lady**, English art critic: b. Ilfracombe 2 Sept. 1840. She was married to Mark Pattison in 1862 and to Sir C. W. Dilke (q.v.) in 1885. She was for many years a writer for the 'Saturday' and 'Westminster' reviews, and at one time art critic of the 'Academy.' Her chief work is 'The Renaissance in France' (1879), illustrated by herself. Her other publications include: 'The Shrine of Death' (1886); 'Art in the Modern State' (1888); 'The Shrine of Love and Other Stories' (1891); 'French Painters of the 18th Century' (1899); 'French Architects and Sculptors of the 18th Century' (1900); 'French Decoration and Furniture in the 18th Century' (1901).

**Dill, James B.**, American corporation lawyer: b. about 1855. He was graduated at Yale in 1876, and from the law school of the University of the City of New York 1878. He has drafted, in whole or in part, the charters of more than 700 corporations and has written various monographs on matters connected with corporation law, among them: 'The Advantages of Business Corporations,' which has been very widely circulated. It was at his suggestion that New Jersey adopted the Corporation Registration Law, which gave New Jersey corporations the same protection afforded by the English system. See CORPORATIONS.

**Dill** (*Anethum graveolens*), the common name for an aromatic plant of the carrot family (*Umbelliferae*). It is a native of Spain, but has been naturalized throughout the civilized world, where the climate is suitable for its growth. It is a particular favorite with the German people, who use it to flavor cucumber pickles, and therefore try to raise it wherever they may be living. In England it is used for the manufacture of gin, and to a small extent in medicine, as a carminative for children. An East Indian species is one of the ingredients in curry powder. It is a hardy biennial plant, growing upright. It has a single slender stem, and leaves finely divided or pinnatifid. The flowers, which form an umbel, appear in June or July. The seed is of an oval form, convex on one side, flat on the other, having three striæ on the outside, and surrounded with a small membranous border. Its taste is slightly acrid, and its odor stronger but less pleasant than that of fennel, to which it is closely allied. In America, where found out of gardens, it is a fugitive from cultivation, and is generally called fennel.

**Dilleniaceæ**, dil-lē-nī ā'sē-ē, an order of plants nearly related to the *Ranunculaceæ*, found chiefly in Australia, Asia, and the warm parts of America. Sepals five, persistent; petals five, deciduous, in a single row; seeds universally arillate; stamens indefinite, hypogenous. The species are trees, shrubs, or under-shrubs. The Indian species are remarkable for their beauty,

the grandeur of their foliage, and the magnificence of their flowers. They have astringent properties, and some of the species afford excellent timber. Lindley enumerated 26 genera, comprising 200 species.

**Dillenius**, dil-lā'nē-oos, or **Dillen, Johann Jakob**, yō'hān yā'kōb, German botanist: b. Darmstadt 1687; d. Oxford, England, 2 April 1747. He was distinguished for his investigations into the propagation of plants, particularly cryptogamous plants. In 1721 he went to England, where he published several works, and particularly 'Hortus Elthamensis' (1732), in which the drawings, prepared by himself, are distinguished by the greatest faithfulness. His last work, on the mosses, 'Historia Muscorum,' added much to his reputation.

**Dillingham, William Paul**, American statesman: b. Waterbury, Vt., 12 Dec. 1843. He studied law, was admitted to practice in 1867, and was state attorney, Washington County, Vt., 1872-6. He was a member of the Vermont legislature 1876 and 1884; state senator 1878 and 1880; commissioner of State taxes 1882-8, and governor of Vermont 1888-90. Since 1890 he has been president of the Waterbury National Bank. He was elected United States senator in October 1900 to fill a vacancy caused by the death of Justin S. Morrill.

**Dillmann, dil'mān, Christian Friedrich August**, German Orientalist: b. Illigen, Württemberg, 25 April 1823; d. 4 July 1894. In 1854 he accepted a call to Kiel, where he became professor of Oriental languages in 1860, but was transferred in 1864 to the chair of Old Testament exegesis at Giessen, which in 1869 he resigned to become Hengstenberg's successor at Berlin. Dillmann was beyond question the first authority in Europe on the Ethiopic languages. The best books for the student in this department of learning are his: 'Ethiopian Grammar' (1857); 'Ethiopian Dictionary' (1865); and his 'Ethiopian Selections' (1866). Other works (1879-84) deal with the history of the Ethiopic kingdom of Axum.

**Dillon, John**, Irish politician, son of John Blake Dillon, who was a prominent member of the Young Ireland party, and member of the British Parliament for County Tipperary in 1865-6: b. New York 1851. He early identified himself with the Parnellite movement, and in 1880 was elected to Parliament for County Tipperary. In the House of Commons Dillon soon became prominent for the violence of his language, while speeches delivered by him in Ireland led to his imprisonment in 1881, 1881-2, and 1888. From 1883 to 1885 he was absent from political life on account of ill-health; but in the latter year he reappeared and was elected for East Mayo. He was one of the most prominent promoters of the "Plan of Campaign." In 1896 he succeeded Justin M'Carthy as chairman of the main section of the Nationalist Party.

**Dillon, John Forrest**, American lawyer: b. Montgomery County, N. Y., 25 Dec. 1831. Going to Iowa in early youth, he was graduated at the medical department of Iowa University, but soon gave up medical practice and studied law, being admitted to the bar in 1852. He was State prosecuting attorney 1852-8; judge of the supreme court of Iowa 1863-9; and judge of the United States circuit court, 8th judicial

district, 1869-79, when he resigned. From 1879-82 he was professor of real estate and equity jurisprudence in Columbia Law School, and has since then practised law in New York, being general counsel of the Missouri Pacific Railway Company; and the Western Union Telegraph Company; and consulting counsel of the Manhattan Elevated and Pacific Railway companies. Among his works are: 'United States Circuit Court Reports'; 'Municipal Corporations'; 'Removal of Causes from State to Federal Courts'; 'Municipal Bonds'; and 'Laws and Jurisprudence of England and America.'

**Dilman**, dēl'mān, Persia, city in the province of Azerbaijan, 75 miles west of Tabreez. It is of considerable extent, and is surrounded by gardens. Pop. estimated at 10,000.

**Dilolo** (dē-lō'lō) **Lake**, a small body of water in Central Africa, discovered by Dr. Livingstone (1854). Its altitude is nearly 5,000 feet above the sea. It is supposed to be connected with both the Zambesi and Congo rivers.

**Dil'uents**, remedies that increase the proportion of fluid in the blood. They are employed in fevers to lessen thirst and increase secretion, and are used in certain acrid affections of the stomach and intestinal regions. Water is the only real diluent, though it may be given in various forms — soups, barley-water, toast-water, milk, lemonade.

**Diluvium**, a term first used by the English geologist Buckland in 1823, and applied by him to the deposits between the Tertiary system and those now in process of formation. He regarded them as the discharge from a universal flood. The diluvium thus includes the boulders, sands, and clays which Lyell included under the name Pleistocene and Morlot under the name Quaternary. Though the term diluvium is no longer used, the adjective diluvial is still employed, especially by foreign geologists. See GLACIAL PERIOD; PLEISTOCENE; QUATERNARY.

**Dime** (Fr. *dîme*, contraction of *dixième*), a silver coin of the United States, of the value of 10 cents, or one tenth of a dollar. It was first coined in 1796 in pursuance of the act of 2 April 1792, though pattern pieces were struck in 1792. Its legal standards have been as follows: by act of 2 April 1792 fineness 892.4 thousandths, weight 41.6 grains; by act of 18 Jan. 1837 fineness 900 thousandths, weight 41¼ grains; by act of 21 Feb. 1853 fineness 900 thousandths, weight 38.4 grains. See COIN; NUMISMATICS.

**Dimensions**, a term used in physics in expressing the mode of dependence of a secondary unit upon the fundamental units from which it is derived. Thus the volume of a rectangular solid is found by multiplying the length by the breadth, and this product again by the thickness; or, in other words, by forming a product that is composed of three factors, each of which is a length. This is expressed, in the terminology of modern physics, by saying that volume (or "bulk") is of the "dimensions"  $L^3$ ; or that it is of dimensions  $+3$  in length. Similarly, the speed with which a body is moving is found by dividing some particular distance that is traversed by the body, by the time that is required to traverse it. The "dimensions" of speed are therefore said to be  $LT^{-1}$ ; or speed is said to be of dimensions  $+1$  in length, and  $-1$  in time.

Three fundamental units are required in order to express the ordinary units of mechanics in this way. Some latitude is possible in their selection, but most writers adopt (1) a definite mass, (2) a definite length, and (3) a definite interval of time. An example of a mechanical unit that contains all three of these units is afforded by energy. The kinetic energy of a body is found by multiplying a mass by the square of a velocity; and hence the dimensions of energy are expressed by the formula  $ML^2T^{-2}$ , so that energy is of the dimensions  $+1$  in mass,  $+2$  in length, and  $-2$  in time. As an example of the determination of the dimensions of a quantity by indirect means, force may be considered. Work is defined as the product of force and distance; so that it may be written  $FL$ . Now energy, since it is capable of becoming transformed into work, must be of the same dimensions as work; and hence we must have  $FL = ML^2T^{-2}$ , from which it is easily seen that  $F = MLT^{-2}$ . In other words, force is of dimensions  $+1$  in mass,  $+1$  in length, and  $-2$  in time. The correctness of this result is easily verified by direct calculation. Thus momentum, being the product of a mass by a velocity, is of the dimensions  $MLT^{-1}$ ; and since force is measured by the increase of momentum that it can produce in a given time (or, in other words, force is determined by dividing a given change of momentum by the time required to produce that change), the dimensions of force must be  $MLT^{-1} \div T = MLT^{-2}$ , which is identical with the result previously obtained. The theory of dimensions is of great importance in connection with problems involving a change of the fundamental units from one system to another; as, for example, in translating the values of physical quantities that have been determined in the metric system, into their equivalents as expressed in the system of units in use in England and the United States. For these important applications, and for the extension of the fundamental principles to the discussion of problems in electricity and magnetism, consult J. D. Everett, 'Units and Physical Constants.' See UNITS.

**Dimet'rodon**, a primitive reptile of the Permian period in which the neural spines of the vertebræ are greatly elongated, making a high rigid fin on the back. The teeth indicate carnivorous type habits, and the animal appears to have been terrestrial or amphibious. In the allied *Naosaurus* a series of short cross-spines project on each side from the neural spine, like the yards of a ship from the masts. The use of this very curious structure is quite unknown. The animal attained a length of 10 or 12 feet.

**Dimin'utive**, in grammar (from the Latin *diminutivum*), an affix, which conveys the idea of littleness, and all other ideas connected with this, as tenderness, affection, contempt, etc. The opposite of diminutive is augmentative. In Latin, diminutives almost always ended in *lus*, *la*, or *lum*; as *Tulliola*, *meum corculum*, little Tullia, my dear or little heart.

The Italian is particularly rich in diminutives and augmentatives: *ino*, *etto*, *ello*, convey the idea of smallness, dearness, etc.; *one*, of largeness; *uccio*, sometimes of smallness, with reproach, but often without it; *accio* signifies that the thing is disgusting, unpleasing, etc.; for

## DIMITRY — DINAPAC ROCKS

example, *casa* is a house; *casetta*, *casina*, *casella*, a small house, nice little house; *casone*, a large house; *casuccia*, a small, insignificant house; *casaccia*, an ugly house. That expressive tongue can compound two or three of these endearing affixes; and travelers may frequently hear little Italian children form almost endless words, as if overflowing with tenderness; for instance, *fratellinucciettinetto*. Adjectives also can receive the diminutive termination; as *carino*, *carinuccio*, from *caro*. In Spanish there are similar diminutives, augmentatives, and other affixes. Thus from *hombre*, a man, are formed the augmentatives *hombron*, *hombrazo*, *hombronzazo*, *hombrachon*; and from *muger*, a woman, *mugeron*, *mugeraza*, *mugeronaza*. Diminutives in *ito* and *ico* usually denote endearment or tenderness, as those in *illo* do sometimes; those in *elo* always denote contempt. In Portuguese the diminutives and augmentatives correspond to those of the Spanish language. In French there are many diminutives formed from other words; as, *tablette*, of *table*, *charette* of *char*; but there is no general affix which can be added to every substantive. The German has the syllables *chen* (in Low German, *ken*, with which corresponds the English *kin*, as in *manikin*, and some other words), *lein* and *el*, for substantives; *lich*, etc., for adjectives; *lich* corresponds to the English *ish* or *like*; for instance, *rundlich*, roundish or roundlike (from *rund*, round). The German even adds the diminutive to pronouns, and nurses will sometimes say *duchen*, from *du*, thou.

The English language affords examples of diminutives, but has no affix which can be used at pleasure to convey this idea. Those commonly used are *ock*, *kin*, *el*, *ling*, and *et*; as in *bullock*, *lambkin*, *kernel*, *gosling*, and *tablet*. Diminutives of proper names are also formed, in colloquial and familiar language, by adding *y* or *ie* to the names, as *Charley*, *Johnny*, etc.

**Dimitry, Charles Patton**, American novelist: b. Washington 31 July 1837. He was educated at Georgetown College, and after serving as a private in the Confederate army, was connected with newspapers in several cities of the North and South. He is State historian of the Louisiana Society of the American Revolution. Among his works are: 'Guilty or not Guilty'; 'Angela's Christmas'; 'Gold Dust and Diamonds'; 'The House in Balfour Street'; 'Louisiana Families'; 'Louisiana Story in Little Chapters.'

**Dimitry, John Bull Smith**, American author and editor: b. Washington, D. C., 27 Dec. 1835; d. New Orleans 7 Sept. 1901. He entered the Confederate army of Tennessee in 1861, serving till 1864, being wounded at the battle of Shiloh. He resided in the United States of Colombia 1874-6, filling the position of professor of languages in the Colegio Caldas, Barranquilla. He was long connected with the press, being for seven years dramatic and literary editor of the New Orleans *Times*, and wrote a 'History and Geography of Louisiana,' which has been used as a text-book.

**Dimity** (Gr. *di-* double, *mitos*, thread; literally, made with a double thread), a stout cotton fabric, ornamented in the loom either by raised stripes or fancy figures; stripes are the most common, as the mounting of the loom is much simpler and the texture can be produced at

less expense. It is rarely dyed, but usually employed white, as for bed and bed-room furniture. There is also a much finer cotton stuff on the market to-day which is manufactured for summer-dress material.

**Dimmesdale**, *dimz'däl*, **Arthur**, the erring clergyman in Nathaniel Hawthorne's tale, 'The Scarlet Letter' (q.v.).

**Dimor'phism** (from the Gr. *dimorphos*, of double form), in crystallography, the crystallization of a body in forms belonging to two different systems, or in incompatible forms of the same system. In biology, the occurrence of individuals of the same species in such a form, that, were not their relation known, they might be considered as separate and distinct in species and even in genera. Thus, in sexual dimorphism, the male and female of the same species present distinct characters, the male may be winged, the female wingless.

**Dimor'phodon**, a genus of Lias bird-like reptiles, found in the south of England. The large head has powerful jaws, with large anterior teeth which are pointed, and small posterior teeth which are lancet-shaped. This is the earliest of the reptiles that were capable of flight. See PTERODACTYL.

**Dimsdale**, **Thomas**, English physician: b. Essex 6 May 1712; d. Hertford 30 Dec. 1800. He published: 'The Present Method of Inoculation for the Smallpox' (1767). He was famous as an inoculator, making journeys in 1768 and 1784 to Russia to inoculate the Empress Catharine and other magnates.

**Dinah Morris**, the heroine of George Eliot's novel, 'Adam Bede' (q.v.). She is a factory girl and at the same time a lay preacher whose purity, spirituality, strength, and tenderness have an uplifting influence on all who come in contact with her. The beauty of her character is especially developed in her intercourse with the guilty and condemned Hetty Sorrel (q.v.). Elizabeth Evans, an aunt of George Eliot, appears to have been the original from whom the character was drawn.

**Dinajpur**, *dē'nāj-poor*, or **Dinagapore**, India (1) A district in the Rajshahi division. Area 4,118 square miles; pop. 1,555,835. (2) A city and capital of the district, 205 miles north of Calcutta. Pop. 12,204.

**Dinan**, *dē-nān* (ancient DINNANUM, fortress on the water), a town in the department of Côtes-du-Nord, France, 16 miles south of St. Malo. It is noted more for its trade than for its manufactures. Pop. 10,000.

**Dinant**, *dē-nān* or *dē-nānt'*, Belgium, a town in the province of Namur, on the Meuse, 14 miles south of the city of Namur. It was fortified as early as the 12th century. In 1466 Philip the Good, Duke of Burgundy, besieged it with 50,000 men; and having taken it by assault, razed it to the ground, and threw 800 of its inhabitants, tied in pairs, back to back, into the Meuse. Paper-mills, tanneries, breweries, and bake-shops are the chief industries. It is noted for its gingerbread made of rye flour and honey. Pop. 7,208.

**Dinapac**, *dē-nā-pāk'*, or **Guinapak, Rocks**, Philippines, two tower-like rocks, lying east of Camiguin Island, north of Luzon. On 2 Nov. 1899, the United States ship Charleston struck an uncharted coral reef three miles north of

Dinapac Rocks and was totally wrecked. All signs of the wreck disappeared in a heavy typhoon a few weeks later.

**Dinapur**, dē'nā-poor, India, a city in the district of Patna, on the Ganges, about 12 miles northwest of Patna. It is one of the great stations of the British army in India. Pop. 44,419.

**Dinar**, dē-nār' or dī'nēr (Lat. *denarius*), formerly an Arab gold piece weighing about 65.4 grains troy. Also a Persian coin. It is now the name of the chief Persian coin, value one franc.

**Dinar'chus**, Greek orator: b. Corinth 361 B.C.; d. Athens 291 B.C. He studied under Theophrastus, and was most successful during the reign of Demetrius Phalereus. After the fall of Demetrius he fled to Chalkis, and returned to Athens in 292 B.C. Of his speeches, of which there were probably about 60, only three are preserved, one of them directed against Demosthenes.

**Dinar'ic Alps**, the name applied to the mountains connecting the Julian Alps with the Balkan system. The main range stretches from northwest to southeast, separating Dalmatia from Bosnia and Herzegovina, as far as the mouth of the Narenta. The mountains are principally calcareous; the highest summits are Orjen 6,225 feet, and Dinara 5,940 feet.

**Dinas Bricks** are highly valued on account of their refractoriness or infusibility. They are made of a peculiar rock, containing 98 per cent of silica, with a little alumina, which occurs at Dinas in the vale of Neath, Wales. This fire-clay brick is very highly esteemed on the other side of the Atlantic. An imitation of it is made in Austria from quartz rock.

**Dincklage-Campe**, dīnk'lāg-ē-kām'pē, **Ama-lie (Emmy) von**, German novelist: b. Campe, Osnabrück, 13 March 1825; d. Berlin 28 June 1891. Her first novel, 'The Loving Old Couple,' was published in 1857. Though she traveled extensively and observantly in Europe and America, her themes for stories were nearly all from her own countryside; and she is called "the poetess of the Ems valley." Among her works are: 'The School of the Heart'; 'Tales of Home'; 'Pictures of Emsland'; (posthumously) 'Poems'; a story, 'The Woman Nihilist' (1893).

**Dindigal**, India, a city in the Madura district, Madras, with a fort on a rocky height. It manufactures cigars, and trades in tobacco and coffee. Pop. 20,203.

**Dindings**, dīn-dīngz', **The**, a British possession belonging to the Straits Settlements, consisting of two small islands and a strip of land on the coast of Perak on the west side of the Malay Peninsula; area about 200 square miles. See STRAITS SETTLEMENTS.

**Dindorf, Wilhelm**, vīl'hēlm dīn'dōrf, German classical scholar: b. Leipsic 2 Jan. 1802; d. there 1 Aug. 1883. He became in 1828 professor of literary history at Leipsic, but resigned in 1833 in order to devote himself entirely to literary work. He contributed to the edition of Aristophanes by Invernizzi and Beck (1820-34), and between 1835 and 1839 published at Oxford an edition of the same poet. Other works by him are editions of Æschylus (1841-51); Euripides (1834-63); Sophocles (1832-6); and De-

mosthenes (1846-51); 'Lexicon Sophocleum' (1871); 'Lexicon Æschyleum' (1873-6); and a new edition of Stephens' 'Thesaurus Linguae Græcæ' (1831-65).

**Dindymene**. See CYBELE.

**Dingelstedt, Franz von**, frānts fōn dīng'-ēl-stēt, BARON, German poet and dramatist: b. Halsdorf, Upper Hesse, 30 June 1814; d. Vienna 15 May 1881. His 'Songs of a Cosmopolitan Nightwatchman' (1841) shocked all officialdom, but had a great popular success; and his 'Poems' (1845) showed true poetic feeling and great descriptive power, the latter also visible in his travel sketches and stories; one of the most successful of the latter is 'The Amazon,' a society novel. His tragedy, 'The House of the Barneveldts' (1851) was a splendid success. He adapted plays from Molière, Shakespeare, and others, to the German stage, and wrote a volume of 'Studies and Copies After Shakespeare.'

**Dingle**, Philippines, a city of Panay, in the province of Iloilo; on Jalaur River, 18 miles north of the city of Iloilo. Pop. 11,000.

**Dingler, Johann Gottfried**, yō'hān gōt'frēd dīng'lēr, German chemist: b. Zweibrücken 2 Jan. 1778; d. Augsburg 19 May 1855. From 1806 to 1820 he conducted journals for calico printing, dyeing, and bleaching, and in 1820 began the well-known periodical called after him 'Dingler's Polytechnic Journal,' which at the time of his death had reached the 140th volume. The journal he founded still continues.

**Dingley, Nelson**, American legislator: b. Durham, Maine, 15 Feb. 1832; d. Washington, D. C., 13 Jan. 1899. He was graduated from Dartmouth College in 1853; admitted to the bar in 1856; purchased the Lewiston 'Journal' in 1856; edited a daily edition in 1865; and was its editor and proprietor till his death. He was elected to the State legislature in 1861; served in that body till 1865 and in 1868 and 1873, and was speaker of the House in 1864-5. He was elected governor of Maine in 1873, and re-elected in 1874; and was a member of Congress from 1881 till his death. From the beginning of his congressional career he was conspicuous as an advocate of the principle of protection and was author of the Dingley Bill (q.v.) of 1897. In 1898 he was appointed a member of the Joint High Commission.

**Dingley Bill**, **The**, in American history, a tariff law, enacted by Congress in 1897, and so named after Nelson A. Dingley who introduced the bill. The Dingley Bill was a revision of the Wilson and McKinley bills and increased the customs duties on wearing apparel and manufactured goods generally. See UNITED STATES — TARIFF IN THE.

**Dingo**, the Australian wild dog (*Canis dingo*), the only species of dog known to exist in both the wild and the domesticated states. It is sometimes considered as being of Asiatic origin, the theory being that it was brought to Australia by the first men who came there, and that it has since become wild. It is not found in Tasmania or New Zealand, in which the fauna is generally like that of Australia. The dingo has decreased in numbers, retreating before the advance of civilization, and suffering from the war made upon it by the settlers, whose flocks it preys upon. The animal is about two

and a half feet long, and nearly two feet high; has large erect ears and a bushy tail. It is tawny in color; some specimens, however, being pale and others almost black. In the wild state it is especially crafty and courageous, and hunts in packs sometimes containing 100 dogs. The native Australians seek the young dingoes, and having taken them from the lairs where they are found, bring them up as domestic animals. When well treated they are affectionate and trustworthy, and are used to help their masters in hunting the animals on which the natives live—opossums, snakes, lizards, etc. While the domesticated dingo is his friend and companion, the native Australian will hunt the wild dog, kill him, and having roasted him, will eat him with a keen appetite. Consult: Lydekker, 'New Natural History,' Vol. I. (1897). See Dog.

**Dingrás**, Philippines, city in the province of Ilocos Norte, in Luzon, 11 miles southeast of Laoag. It is on the Grande de Laoag River. The surrounding country is fertile. Pop. 12,600.

**Dinichthys** (Gr. *deinos*, terrible; *ichthys*, fish), a genus of enormous fossil fishes found in Carboniferous and Devonian rocks. They are usually classed with the *Dipnoi* (q.v.) as members of the order *Arthrodira*.

**Dinic'tis**, a genus of sabre-tooth tigers of the Oligocene Epoch in North America. The animal was as large as a Canada lynx, and of somewhat the same proportions, but with long tail. Its teeth were less specialized than in the later sabre-tooth tigers or the modern cats, 34 being retained out of the 44 which all primitive mammals possessed. It has many characters allying it with the civets (*Viverridae*), and especially with the fossa (q.v.) of Madagascar, indicating the descent of cats and civets from a common ancestor.

**Diniz**, *dē'nēs*, Julio, pseudonym of Joaquim Guilherme Gomes Coelho, Portuguese novelist and poet: b. Oporto 14 Nov. 1839; d. there 12 Sept. 1871. He introduced the village story into Portuguese literature. His first work: 'The Rector's Wards' (1866), is also his best; it was followed by 'An English Family' (1867), describing middle-class life in Oporto. His poems were published in 1880.

**Diniz da Cruz e Silva**, Antonio, *ân-tō'nē-ō dē'nēs dā kroos ē sêl'vā*, Portuguese poet: b. Lisbon 4 July 1731; d. Rio Janeiro, Brazil, 5 Oct. 1799. A lawyer and official, in 1776 he was made counsel to the superior court at Rio Janeiro. He was one of the founders of the celebrated literary society, the Lisbon Arcadia. His poetry comprises sonnets, eclogues, elegies, songs, epigrams, epistles, and several volumes of Pindaric odes; a lengthy poem, 'Brazil's Metamorphoses'; and a heroicomic epic, 'Hyssop,'—modeled on Boileau's 'Lutrin,' but a spirited, original composition, far superior to Boileau's,—which was republished several times in France, and translated into French prose.

**Dinka**, a powerful tribe of Negritos who live on both sides of the White Nile between lat. 6° and 12° N. Their territory covers 60,000 square miles. They are intelligent, have some skill in making articles for household use, and also follow agriculture. Each village is governed by its own chief. Consult: Schweinfurth, 'In the Heart of Africa.'

**Dinkard** (the enactments of religion), an important compilation of information concerning the doctrines, customs, and writings of the religion of Zoroaster. In its present form, much of the work is a descriptive list of the contents of a larger and earlier work.

**Dinocer'ata** (Gr. *deinos*, terrible, and *kéras*, horn), an extinct order of mammals, approaching the elephant in size and movements, remains of which have been found extensively in the Eocene lacustrine sediments of southern Wyoming. The dinocerata include three genera—*Uintatherium* (most primitive type), *Dinoceras* (intermediate form), and *Tinoceras* (youngest and most specialized). About 30 more or less distinct forms have been recognized.

**Dinorah**, *dē-nō'rā*, the title of an opera by Meyerbeer, produced in Paris 4 April 1859. The opera is now rarely presented. Its single effective scene is a shadow dance, with accompanying song.

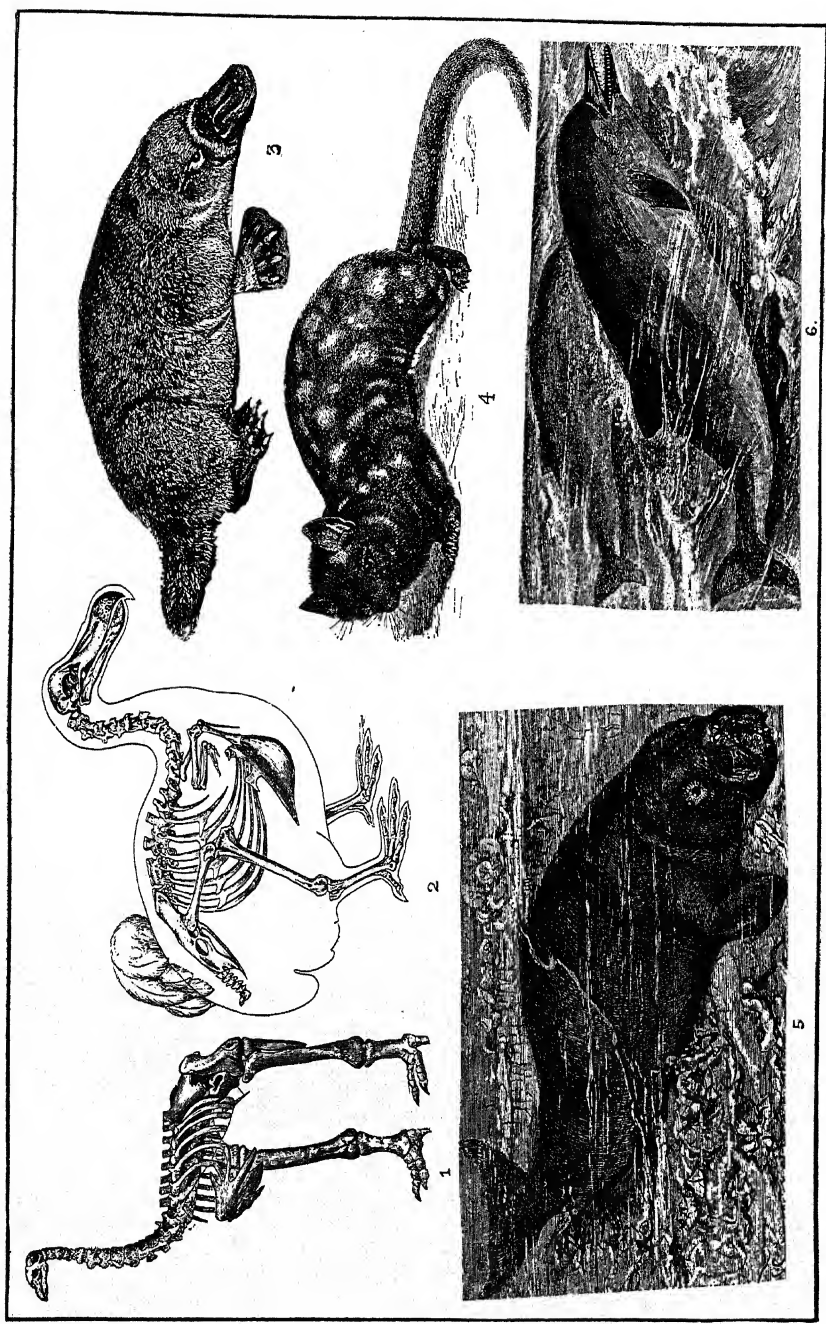
**Dinor'nis**, a genus of large wingless birds, classed among the *Struthionidae* or ostrich tribe, the fossil bones of various species of which have been found in New Zealand. These birds had bones devoid of air-passages, were three-toed, and some of them must have been of immense size. The *D. giganteus*, for example, is estimated to have been about 12 feet tall. See DINORNITHES.

**Dinornithes**. A group of extinct, flightless, ratite birds of gigantic size, the moas of New Zealand, with small heads, stout legs, usually with a hallux, wings absent or extremely reduced, furculum absent, and aftershafts large. The genera were *Dinornis*, *Pachyornis*, *Mesopteryx*, *Anomalopteryx* and *Megalopteryx*. See MOA.

**Dinosauria**, *dī-nō-sā'rī-ā*, an extinct order of *Reptilia*, with many characters allying them to birds in the structure of the skull and skeleton. The body was covered with scales or bony plates, the limbs long and stilted, the tail massive, and equaling or exceeding the rest of the body in length. Many of them were of gigantic size, beyond that of any other land animals living or extinct, and exceeded only by the whales. During the Triassic, Jurassic, and Cretaceous periods, this group was the dominant form of terrestrial life, occupying the same relative position as did the mammalian quadrupeds during the Tertiary, or as does man at present. The most ancient known dinosaurs of the Triassic Period were carnivorous land animals of moderate size, and comparatively light and agile; later appeared huge, massive herbivorous quadrupedal and bipedal types, some scale-covered, others with heavy bony plates, spines, horns, and frills to protect them against their carnivorous enemies. They disappeared at the close of the Cretaceous Period, leaving no descendants or near relatives. Like other reptiles, they appear to have been cold-blooded, slow-moving, and unintelligent compared with the mammals which succeeded them, and less able to adapt themselves to the new conditions of life brought about by gradual changes of climate during geologic time. Their extinction paved the way for the predominance of the mammals and their evolution into the various modern races.

Dinosaurs are divided into three or four orders or sub-orders of very diverse appear-





1. Skeleton of the Elephant-footed Dinornis.  
 2. Skeleton and Outline of the Dodo.  
 3. Duckbill (*Ornithorhynchus anatinus*).  
 4. A typical Paradoxure (*Dasyurus viverrinus*).  
 5. Manatee (*Manatus americanus*).  
 6. Dolphin (*Delphinus delphis*).





## DINOTHERIUM — DINWIDDIE COURT-HOUSE

ance: (1) *Sauropoda*, or amphibious dinosaurs, quadrupedal, herbivorous, with long neck, small head, weak teeth, short elephantine five-toed feet, and blunt claws. These have been found only in Jurassic and Lower Cretaceous strata, and include the largest members of the sub-class. *Brontosaurus*, *Diplodocus*, *Camarasaurus*, and *Morosaurus* are the best known. (2) *Theropoda*, or carnivorous dinosaurs, bipedal, carnivorous, with sharp teeth, bird-like hind legs and feet, three-toed or four-toed, and large sharp claws on both fore and hind feet. It includes *Megalosaurus*, *Allosaurus*, etc. (3) *Preidentata*, or beaked dinosaurs, herbivorous terrestrial hoofed types with the front of the jaws covered by a horny bill or beak. These include the most highly specialized and bizarre forms, and were the latest development of the order, found chiefly in the Cretaceous Period. They are divided into three groups: (a) *Iguanodontia*, unarmored, bipedal, with small fore limbs and three-toed bird-like feet (but with hoofs instead of claws). *Iguanodon*, *Claosaurus*, and *Hadrosaurus* are the best known, each about 30 feet long. The skull of *Hadrosaurus* is four feet in length, and behind the horny beak is a magazine of several rows of small rod-like teeth set on end close together and wearing to a tessellated grinding surface like a mosaic pavement. (b) *Stegosauria*, heavy, quadrupedal, with five-toed elephantine feet, small head, large projecting bony plates on the back, and stout spines on the tail. The teeth are small and weak, somewhat like those of the iguana. *Stegosaurus* is the best known. (c) *Ceratopsia*, heavy, quadrupedal, with elephantine feet and very large head, with enormous horns projecting forward, and a great bony frill projecting backward and upward, and completely covering the short thick neck. The skull of *Triceratops* is sometimes eight feet long. The teeth of the *Ceratopsia* are like those of the iguanodonts, but larger and with fewer rows.

The brain in dinosaurs was disproportionately small, especially in the herbivorous types, and indicates a lower order of intelligence than in most modern reptiles. It is greatly exceeded in size by the spinal ganglia in the sacrum which govern the reflex (automatic) movements of the hind limbs and tail. Hence we may infer that the actions of these creatures were largely automatic and unintelligent, and this explains in part why they were unable to adapt themselves to the changes in physical geography, climate, and vegetation which ushered in the Cenozoic or modern era of geological time, and became totally extinct.

Comparatively little was known about the dinosaurs before 1880, but since that time the exploration and research of American palæontologists, and especially of the late Prof. O. C. Marsh in the fossil fields of Wyoming, Colorado, and other western States, have greatly extended our knowledge, and shown how important a part these creatures played in geological history. The proper collecting of these huge skeletons, and their extraction from the rock without injury, is a difficult and tedious operation, and requires considerable funds, so that only a few well-equipped museums have been able to afford it. The chief collections in this country are in the museums of Washington, New York, New Haven, Pittsburg, and Chicago. It is not yet practicable to trace the evolution of the different races of dinosaurs, as has been

done with most of the mammal races, and much remains to be discovered as to the structure and habits even of the better known species.

W. D. MATTHEW,  
*American Museum of Natural History.*

**Dinotherium** (Gr. *δεινός*, terrible; *θηρ*, beast), a genus of elephantine mammals occurring as fossils in the Tertiary rocks of Europe and India, characterized by having the lower incisors developed into dome-curving tusks and by having all the molar teeth in use at once. They probably had a proboscis like that of the elephants.

**Dinsmore, Hugh Anderson**, American lawyer: b. Benton County, Ark., 24 Dec. 1850. He was clerk of the circuit court 1873-4, when he was admitted to the bar, and began practice in Fayetteville; was prosecuting attorney of the 4th judicial district of Arkansas in 1878-84; a Democratic presidential elector in 1884; minister-resident and consul-general in the kingdom of Korea in 1887-90; and a member of Congress in 1893-1903.

**Dinwiddie, Robert**, British colonial official: b. Scotland about 1690; d. Clifton, England, 1 Aug. 1770. He was lieutenant-governor of Virginia 1752-8; and during his official career recommended the annexation of the Ohio valley and the erection of forts to secure the western frontier against the French. He was one of the most earnest supporters of the French and Indian war, which began about 1753 and lasted 10 years.

**Dinwiddie, William**, American journalist and author: b. Charlottesville, Va., 23 Aug. 1867. When only 14 years of age, he was assistant electrician of the National Museum at Washington. He became inspector of customs at Corpus Christi, Texas, in 1883; was connected with the Bureau of American Ethnology from 1886 to 1895, at which time he went into journalism, serving as correspondent and illustrator for the *New York Herald*. He became photographer for the Baltimore & Ohio Railroad in 1897. During the campaign in Cuba and Porto Rico he served as war correspondent. He has published: 'Puerto Rico and Its Possibilities'; 'The War in the Philippines'; 'The War in South Africa.'

**Dinwiddie Court-House and White Oak Road, Battles of.** Gen. Grant, while besieging Petersburg, issued orders 24 March 1865 for a movement on the 29th to destroy the railroads leading into the city from the south, force Gen. Lee to come out of his entrenchments and fight on open ground, or so far attenuate his line that a successful assault could be made. The result was the battle of Five Forks (q.v.), the fall of Petersburg and Richmond, the surrender at Appomattox, 9 April and the close of the Civil War. The movement to the left was led by Warren's Fifth corps and Sheridan's cavalry, and the first encounter was near the Boydton road, where Warren's leading division (Griffin's) defeated two brigades sent out from Lee's right, driving them back to White Oak road. On the 30th the Second and Fifth corps closed in on the White Oak road on Lee's right, and Wilcox's Confederate division, coming out of the entrenchments, attacked Warren and was driven back. Warren's advance division was now within 600 yards of the road, and, on the

31st, Lee ordered another attack. Hunton's and Wise's brigades attacked in front, and McGavan's and Gracie's on the left flank. Ayres' and Crawford's divisions were driven back in disorder upon Griffin's division, which checked the Confederate advance. Gen. Miles, with two brigades of the Second corps, struck Wise's brigade on the left flank, drove it back with severe loss in killed and wounded, and the entire Confederate attacking party retreated, and Warren, resuming the offensive, pushed his advance across the White Oak road. It cost the Second and Fifth Union corps, on the 31st, 1,311 killed and wounded, and 556 missing.

Meanwhile Sheridan had reached Dinwiddie Court-House, 12 miles southwest of Petersburg, and on the 30th Devin's division and Davies' brigade were pushed 10 miles in advance in the direction of Five Forks, where they encountered the Confederate cavalry under Gen. Fitz Hugh Lee. At night Gens. W. H. F. Lee and Rosser joined Fitz Hugh Lee, and Gen. Pickett, with five brigades of infantry, marched down the White Oak road to Five Forks, and assumed command of all the troops operating against Sheridan. Munford's cavalry division engaged Devin in front and Pickett moved with infantry and the other two divisions of cavalry to gain Sheridan's left, crossed Chamberlain's creek, struck Davies' brigade in flank and drove it back on Devin, interposed between Devin and Crook, and with the assistance of Munford drove both Davies and Devin northeastwardly across the country. Fitz Hugh Lee moved up and formed his cavalry on Pickett's flanks. In following Devin and Davies, Pickett had exposed the rear of his column and it was attacked by the brigades of Gibbs and Gregg, which attack forced Pickett to face about. He drove back the two brigades and advanced upon Dinwiddie Court-House. Sheridan had called up Custer with his two brigades, some artillery had come up, and a barricade was thrown up about three fourths of a mile northwest of the court-house, behind which Gibbs and Gregg rallied, and Smith's brigade, slowly driven back by the Confederate cavalry, formed on the left. It was now near sunset, and as Pickett advanced, artillery opened upon him, and when within short range the cavalry from behind the barricades poured such a shower of bullets upon him that he was quickly repulsed, and the battle of Dinwiddie Court-House was over. Sheridan says his loss was about 450. The Union forces engaged at Dinwiddie Court-House and White Oak Road numbered about 42,000; the Confederates about 20,000. The Union loss 29-31 March was 2,198 killed and wounded, and 583 missing. The Confederate loss is unknown. Consult: 'Official Records,' Vol. XLVI.; Humphreys, 'The Virginia Campaign of 1864-5'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; Grant, 'Personal Memoirs,' Vol. II.; Sheridan, 'Personal Memoirs,' Vol. II.; the Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. CARMAN.

**Di'ocese**, the territory and population over which a bishop exercises jurisdiction. The word diocesis was originally a term of civil administration, when toward the end of the 3d century the Roman empire was divided into 12 dioceses governed by the emperor's lieuten-

ants, each diocesis comprising several of the divisions called provinces. When the word came into ecclesiastical use it signified rather one of the grand divisions, patriarchates or primate jurisdictions, instead of the territory presided over by one of the bishops subject to a patriarch or primate or an archbishop. The word began to be used in the meaning it now has in the latter part of the 13th century; but even later it was used in the sense of our present word parish.

**Diocle'tian (Caius Aurelius Valerius Diocletianus, surnamed Jovius)**, Roman emperor: b. Dioclea, Dalmatia, 245 A.D.; d. near Salona, Dalmatia, 313. He was made emperor by the army 284 A.D. and was generally beloved for the goodness of his disposition. But troubles disturbed the Roman empire, and compelled him to share the burden of government with colleagues; at first with M. Aurelius Valerius Maximian (286), who defeated the Gauls. Diocletian, at the same time, was successful against the Persians in the East, and afterward penetrated to the sources of the Danube, in Germany. He subsequently, in 292, named C. Galerius, Cæsar, and Maximian raised Constantius Chlorus to the same dignity. Thus the empire was divided into four parts. Diocletian resigned the imperial dignity at Nicomedia (305), as did Maximian at Milan at the same time. Diocletian retired to Salona in Dalmatia, where he found happiness in the cultivation of his garden. In the latter part of his reign he was induced to sanction a persecution of the Christians, whom he had long protected.

**Diodati, Giovanni**, jō-vān'nē dē-ō-dā'tē, Italian Protestant clergyman: b. Lucca about 1576; d. Geneva 3 Oct. 1649. He was for some time professor, first of Hebrew, then of theology, in Geneva, and in 1619 represented the Genevan clergy at the Synod of Dort, and aided in drawing up the Belgic confession of faith. He is most celebrated for a translation of the Bible into Italian, which is superior to his translation of it into French.

**Diodon**, dī'ō-dōn, a genus of teleostean fish, family *Gymnodontes*, order *Plectognathi*, deriving their name from the fact that the ivory-clad terminations of the jaws show no suture, and the fish thus appear to possess but two teeth. The body, as in other members of the family, can be inflated with air till the creature floats on the surface of the water under side uppermost; it is likewise covered with ossifications in the skin, each with a pair of lateral roots and a stiff, movable, erectile spine. The rotundity of these fish when distended has earned for them the name of globe-fish, or prickly globe-fish, in addition to the designations porcupine-fish and sea-hedgehog, suggested by the numerous spines. The four species of *Diodon* are found in all the seas between the tropics, and range to the Cape of Good Hope. The largest species (*D. hystrix*) attains the length of two feet six inches. The food of *Diodon* consists of crustaceans and seaweeds, for the trituration of which its jaws are admirably adapted. This genus has by some naturalists been made the type of a family *Diodontidae*.

**Diod'orus (surnamed SICULUS)**, Greek historian: b. Agyrium, Sicily; fl. second half of 1st century. In order to render his history as complete and exact as possible, he traveled through a great part of Europe and Asia. It

is very much to be regretted that the greater part of this history, which the author called the 'Historical Library,' in the composition of which he combined the ornaments of rhetoric with the detail of facts, after the example of Theopompus and Ephorus, and on which he had bestowed the labor of 30 years, has not reached our times. It consisted of 40 books, and comprised the history of almost all nations. It is written in the style of annals, and the events are narrated in a confused and discordant manner; but the work is valuable as containing a great mass of materials collected from a number of writers whose works have perished. Only the books 1 to 5 and 11 to 20, and a number of fragments, are now extant.

**Diœcious**, di-ê'shūs, in botany, a term applied to unisexual plants, such as the willow and the hemp, in which the stamiferous and pistilliferous flowers are on separate individuals. In zoology, a term applied to those animals in which the sexes are distinct; that is, those in which the ovum is produced by one individual (female) and the spermatozoid by another (male). It is opposed to monœcious.

**Diog'enes of Apollonia**, Greek philosopher: b. Apollonia, Crete, fl. in the 5th century B.C. Very little is known of his life. His philosophical speculations were developed in his work 'On Nature,' still extant in the 6th century, but of which we have at present only fragments, preserved in the works of Aristotle, Diogenes Laertius, and Simplicius. His great object was to find the first principle of the world, out of which all things were evolved. Like his master Anaximenes, he came to the conclusion that this great first principle was air.

**Diogenes Laer'tius**, Greek philosopher: b. Laerte, Cilicia, toward the close of the 2d century A.D. His chief work is 'Lives, Doctrines, and Apophthegms of those who have distinguished themselves in Philosophy.' The book is full of absurd and improbable anecdotes, and characterized by much confusion and careless mistakes, yet as containing a mine of information regarding the private life of the Greeks, and many fragments of works now lost, it is of considerable value. It was long the foundation of most modern histories of philosophy, and has preserved the names and doctrines of numerous writers, of whom but for it little would have been known.

**Diogenes of Sino'pe**, the most famous of the Cynic philosophers, was born about 412 B.C., in Sinope, a city of Pontus in Asia. Having been banished from his native place with his father, who had been accused of coining false money, he went to Athens, and requested Antisthenes to admit him among his disciples. That philosopher in vain attempted to repel the importunate suppliant, even by blows, but finally granted his request. Diogenes devoted himself, with the greatest diligence, to the lessons of his master, whose doctrines he extended still further. At the same time he applied, in its fullest extent, his principle of divesting himself of all superfluities. He taught that a wise man, in order to be happy, must endeavor to preserve himself independent of fortune, of men, and of himself: in order to do this, he must despise riches, power, honor, arts, and sciences, and all the enjoyments of life. He endeavored to exhibit, in his own person, a model of Cynic

virtue. For this purpose he subjected himself to the severest trials, and disregarded all the forms of polite society. He often struggled to overcome his appetite, or satisfied it with the coarsest food; practised the most rigid temperance, even at feasts, in the midst of the greatest abundance, and did not even consider it beneath his dignity to ask alms. By day he walked through the streets of Athens barefoot, without any coat, with a long beard, a stick in his hand, and a wallet on his shoulders; by night he slept in a tub, though this last has been doubted. He defied the inclemency of the weather, and bore the scoffs and insults of the people with the greatest equanimity. Seeing a boy draw water with his hand, he threw away his wooden goblet as an unnecessary utensil. He never spared the follies of men, but openly and loudly inveighed against vice and corruption, attacking them with satire and irony. The people, and even the higher classes, heard him with pleasure, and tried their wit upon him. When he made them feel his superiority, they often had recourse to abuse, by which, however, he was little moved. On a voyage to the island of Ægina he fell into the hands of pirates, who sold him as a slave to the Corinthian Xenias in Crete. The latter emancipated him, and entrusted him with the education of his children. In summer he lived at Corinth, and in winter at Athens. It was at the former place that Alexander found him on the roadside basking in the sun, and astonished at the indifference with which the ragged beggar regarded him, entered into conversation with him, and finally gave him permission to ask for a boon. "I ask nothing," answered the philosopher, "but that thou wouldst get out of my sunshine." Surprised at this proof of content, the king is said to have exclaimed: "Were I not Alexander, I would be Diogenes." At another time he was carrying a lantern through the streets of Athens in the daytime: on being asked what he was looking for, he answered, "I am seeking a man." Thinking he had found in the Spartans the greatest capacity for becoming such men as he wished, he said, "Men I have found nowhere; but children, at least, I have seen at Lacedæmon." We are told that Socrates once remarked to him, "I see your vanity through the holes of your coat"; but chronology will not admit of the truth of this anecdote. No doubt many of the anecdotes told of this singular man are fiction. He died 323 B.C., at a great age. When he felt death approaching, he seated himself on the road leading to Olympia, where he died with philosophical calmness, in the presence of a great number of people, who were collected around him.

**Diogne'tus, Epistle to**, a defense of the beliefs and the religious and social usages of the Christians, written in the 1st century by one who appears to have been himself a disciple of the apostles, but of whose name and history nothing is known. He refutes the false and malicious accusations brought against his brethren—as that in their assemblies they were wont to practise abominable immoralities, that they were atheists, enemies of all government, etc. He writes with the simplicity and candor of one who has nothing to conceal or to explain away; who rather pities the ignorance of the persecutors than reproaches them for their cruelties.

## DIOMEDE ISLANDS — DIONYSIUS THE AREOPAGITE

and injustices. "The Christians," he writes, "live in their fatherland, but like wayfarers in a strange land; citizens themselves, they share with their stranger brethren; they calmly bear all adversities; they find a fatherland everywhere: but their earthly fatherland is an exile. They marry, like others, but unlike others they do not expose their babes. They live in the flesh, but not according to the lusts of the flesh. They are dwellers on earth, but their true home is heaven. They obey the laws and by their mode of life rise superior to all law. They love all mankind, and all men persecute them. They are delivered up to death and death is for them deliverance."

**Di'omede Islands**, a group of three small islands in Bering Strait, and midway between Asia and America. They were discovered by Bering in the early part of the 18th century.

**Diomedea**, *dī-ōm-ē-dē'ā*, a genus of birds, including the various species of albatross (q.v.).

**Diome'des**, king of Argos. He was one of the heroes at the siege of Troy, the son of Tydeus. His daring courage rendered him one of the most distinguished heroes, and, according to the testimony of Nestor, superior to all his contemporaries. Protected by Pallas, he not only encountered the most valiant of the enemies, many of whom he killed, but even ventured to attack the immortals. He was equally distinguished in the council. He boldly opposed the proposal of Agamemnon to leave the plains of Troy without having gained the object of the expedition, and prevailed; he even adhered to his opinion after Achilles had rejected the proffered reconciliation. By carrying off the horses of Rhæsus from the enemies' tents he fulfilled one of the conditions on which alone Troy could be conquered. With Ulysses he removed Philoctetes, who had the arrows of Hercules, from Lemnos, which was another condition of the fall of Troy. Finally, he was one of the heroes who were concealed in the wooden horse by whom the capture of Troy was at length accomplished.

**Diomedes, Villa of.** See POMPEII.

**Di'on Cassius**, Greek historian: b. Nicæa, Bithynia, about 155 A.D.; d. there after 230 A.D. He went to Rome about 180; was appointed successively to many high offices; was twice consul; and wrote, in Greek, the 'History of Rome,' from the arrival of Æneas in Italy to 229 A.D. The small portions extant of Dion's work are highly valued.

**Dion Chrys'ostom.** See CHRYSOSTOM, DION.

**Dion of Syracuse**, in Greek history, a connection by marriage of the elder and the younger Dionysius, tyrants of Syracuse, over whom he long exercised great influence. He attempted to reform the younger Dionysius, but his enemies succeeded in effecting his banishment. He afterward returned and made himself ruler of the city, but became unpopular, and in 353 B.C. was assassinated.

**Dionæa** (*dī-ō-nē'ā*) **Muscip'ula** ("Venus' fly-trap"), a plant of the sundew family (*Droseraceæ*), found in sandy bogs near the coast of the Carolinas. Audubon reported specimens of enormous size as growing also in Florida. It is a common plant in hothouses. It exhibits in a remarkable degree the irritability common to some plants. There are three hairs upon each division of the leaf, which are so

sensitive that an insect alighting upon one of them causes the two sides of the leaf suddenly to come together with considerable force, the strong bristles of the marginal fringe crossing each other like the teeth of a steel-trap, so as to retain the intruder, whose struggles to escape only increase the pressure of the leaf-trap. The insect is retained until its soft parts are digested and absorbed by the plants, after which the leaf opens and the hard parts drop out. This operation requires about 14 days, but if the insect exciting the leaf is not caught, the leaf opens again after an hour or two. The leaf does not retain its vigor for any length of time, gradually becoming inert and drying up. Consult: Darwin, 'Insectivorous Plants.'

**Dio'ne**, in Greek mythology, the mother of Aphrodite (Venus).

**Dionysia**, *dī-ō-nish'ā*, festivals in honor of Dionysus, or Bacchus, which, originating in Egypt, were introduced into Greece by Melampus, 1415 B.C. They were four in number, the Rural or lesser Dionysia, which was the most ancient, the Lenæa, the Anthesteria, and the Dionysia proper, all of which were celebrated annually, with much extravagant merriment, though they were not disgraced by the excesses of the Roman Bacchanalia.

**Dionysius, Saint**, elected pope in the year 259. He is supposed to have been a native of Greece, but the exact date of his birth is not known. He died 26 Dec. 269, having reigned as pontiff 10 years. Prior to his election as pope he was held in high repute by the theologians of his day, as history states that Dionysius of Alexandria sent him a most important letter on baptism; and later he was the chief theologian in a synod (262) where the principal question had reference to the Trinity. His able commentaries convinced many who had held views different from those taught by the Church.

**Dionysius, Saint, "OF ALEXANDRIA":** b. Alexandria in the last years of the 2d century; d. there 265 A.D. His family were noble, wealthy, and pagans. Early in his life his philosophical studies turned his attention to Christian writings, and they so influenced his mind, especially the epistles of St. Paul, that he left the pagan schools and became a pupil of Origen. About the year 232 he was ordained a priest, and given charge of the Alexandrian school of theology. In 248 he was consecrated bishop. Shortly after he became bishop of Alexandria the persecution of Decius began, and Dionysius was among the first arrested, and sentenced to be tortured and beheaded. He was rescued by a band of peasants, and for more than a year remained concealed in the Libyan desert. In 257, during the persecution under Valerian, he was again exiled from Alexandria. The writings of Dionysius were numerous, but many have been destroyed. His works were chiefly controversial, or attacks on the heresies of his day. Consult: Butler, 'Lives of Saints'; the English translation, 'Ante-Nicene Fathers.'

**Dionysius the Areopagite**, converted to Christianity by St. Paul (Acts xvii. 34), during the apostle's visit to Athens. Dionysius is called the Areopagite because he was a member of the high court of Athens, the *Areopagus*, which held its sessions on Mars Hill. It was generally believed by the early historians that this Diony-

## DIONYSIUS THE ELDER — DIOPSIDE

sius was ordained a priest, was made bishop of Athens, and ended his life by martyrdom. The New Testament tells us only that he "did believe" and adhered to St. Paul. He has been wrongfully credited with being the author of certain ancient writings on subjects chiefly mystical which, though attributed to that member of the court of Areopagus who was converted to Christianity by the preaching of the Apostle Paul, Acts xvii. 34, must be referred to some unknown writer of the 4th or the 5th century: hence the author is now usually styled Pseudo-Dionysius, or Dionysius Pseudo-Areopagite. The titles of the works attributed to the Areopagite, and which seem to have been his writings, are 'The Heavenly Hierarchy'; 'The Ecclesiastical Hierarchy,' 'Divine Names,' 'Mystical Divinity.' Ten letters are attributed to him, purporting to be addressed to St. John the Evangelist, Titus, Polycarp, and others, their contemporaries. These writings came first into notice in 533 at Constantinople when certain Monophysite heretics presented them in confirmation of their doctrines: but they were repudiated by the orthodox as manifestly spurious. Nevertheless before long they came into high favor both in the East and the West and throughout the Middle Ages were received by the most eminent schoolmen as indispensable monuments of the teaching and belief of the early Church. Mgr. Darboy says: "There is scarcely a passage in the writings of Pseudo-Dionysius that has not been quoted by Thomas Aquinas."

**Dionysius the Elder**, Syracusan tyrant: d. 367 B.C. He contrived to make himself master of the citadel of Syracuse, together with all the arms and provisions contained in it, and finally to declare himself tyrant, at the age of 25 years. After having finished a short war against the Carthaginians he made preparations for a great war against Carthage. He attacked the Carthaginians at once by land and water, and gained a complete victory, which was soon followed by an advantageous peace. In 368 he commenced a new war against the Carthaginians, intending to drive them entirely out of Sicily. He did not, however, succeed in this attempt, and was obliged to conclude a disadvantageous peace. He holds the unenviable place in ancient history as the representative tyrant. He lived in continual dread of assassination, of which the sword of Damocles has become the symbol. He had the state prison so constructed that even the solitary murmurings of its inmates could be heard by him, and it was hence called the Ear of Dionysius.

**Dionysius the Younger**, Syracusan tyrant. He succeeded his father, Dionysius the Elder. Dion his kinsman directed his attention to the doctrines of Plato, representing to him that this great philosopher alone was able to teach him the art of government, and the means of rendering his subjects happy. In consequence of this advice Dionysius invited Plato to his court. The latter succeeded in tempting him into the path of virtue and knowledge, and in giving a new character to his whole court. An opposite party, however, awakened the king's suspicions against Dion, and caused his banishment. Dion subsequently made himself master of Syracuse, to which Dionysius did not return until after the murder of Dion. The rule of Dionysius now

became so oppressive that Timoleon appeared with a fleet before Syracuse, and expelled the tyrant. Dionysius was carried to Corinth, where he is said to have gained a scanty living by giving lessons in grammar.

**Dionysius, Ear of.** See EAR OF DIONYSIUS.

**Dionysius Exiguus**, an eminent scholar of the 6th century. He it was who introduced the now existing method of calculating the Christian era. He was a monk and, according to his close friend Cassiodorus, was of Scythian origin (*natione Scythia*). His surname Exiguus (little) was perhaps self-assumed by him out of humility, for lowly mindedness is one of the virtues enumerated by Cassiodorus in his eulogy of his friend; but the surname may have had reference to his stature. His reputation was high as a theologian and as one intimately conversant with the Scriptures and with the ordinances of the Church. He is author of a collection of ecclesiastical constitutions and canons which is still extant. Many writings of ancient Greek authors have been saved for us in the translations made of them into Latin by Dionysius.

**Dionysius of Halicarnassus**, Greek critic, historian, and rhetorician: b. about 50 B.C.; d. 7 B.C. He came to Rome about 29 B.C., and lived there on terms of intimacy with many distinguished contemporaries till his death. His most valuable work is his Greek 'Archæologia,' a history of Rome down to 264 B.C. Of the original 20 books, we possess only the first nine in a complete form. He was a greater rhetorician and critic than historian, and his extant works on oratory, on the criticism in detail of the great Greek orators, on the characteristics of poets and historians from the time of Homer to Euripides, and upon Thucydides and Dinarchus, possess great interest and value.

**Dionysus**, di-ō-nī'sūs, the original Greek name of the god of wine, the name Bacchus, by which he was also called by both the Greeks and the Romans, being at first a mere epithet or surname. See BACCHUS.

**Diophantine Analysis**, that branch of algebra which treats of the method of solving certain kinds of indeterminate problems relating principally to square and cube numbers, and rational right-angled triangles. The following are examples: (1) To separate a given square number into two parts, each of which shall be a square number; (2) to find three square numbers which are in arithmetical progression; (3) to find a right-angled triangle whose sides shall be commensurable with each other.

**Diophantus of Alexandria**, Greek mathematician. He flourished, according to some authorities, about the middle of the 4th century, according to others about the end of the 6th. He left 13 books of 'Arithmetical Questions,' of which only six are extant; and a work on 'Polygon Numbers.' See DIOPHANTINE ANALYSIS.

**Diopside**, di-ōp'sīd, a variety of the mineral pyroxene occurring in monoclinic prisms. It is a silicate of calcium and magnesium, having the formula,  $\text{Ca Mg} (\text{SiO}_3)_2$ . Iron is occasionally present in considerable amount, replacing the magnesium, and it then graduates towards hedenbergite. It has a hardness of



## DIOPTASE—DIOSCURUS

about 6, and a specific gravity of about 3.3. It is usually pale green to nearly colorless and when transparent yields gems of considerable beauty. The finest gems come from Dekalb, New York, where it occurs in transparent crystals varying from colorless to a deep, rich green. Ala, Piedmont, is another celebrated locality.

**Dioptase**, *dī-ōp'tās*, a rare, beautiful and highly prized mineral, occurring in prismatic crystals of rich emerald-green color and vitreous lustre. Its inferior hardness, 5, greater specific gravity, about 3.3, the terminal rhombohedrons on its crystals, and its reactions for copper, easily distinguish this so-called "emerald-copper" from the true emerald. It is found sparingly near Clifton and near Riverside in Arizona, also in the French Congo, Chile and Hungary, but the finest specimens are from Russia.

**Diop'trics** (from Gr. *dia*, through, *ōp*, see), the science which treats of the refraction of the rays of light, when the rays pass through different refracting mediums—for instance, from the air, through the lenses of a telescope. Diop'trics, consequently, is a branch of optics. It demonstrates the different directions in which the rays move, according as they are broken on plane or curved surfaces. The principles deduced from these observations determine the nature of the various lenses, explain the manner in which the light is refracted in the human eye, teach the manner of making telescopes, microscopes, etc. The ancients were not acquainted with this science. Natural science in modern times has been greatly indebted to it. By its aid the human eye has been enabled to reach objects previously unknown. Kepler, Snellius of Leyden, Descartes, Newton, etc., not only extended this science, but founded a great part of their discoveries on it. In modern times, science has been enriched by the invention of the achromatic telescope. See LENS; OPTICS; REFRACTION; TELESCOPE.

**Diora'ma**, a method of reproducing landscape scenery, invented or perfected by M. Daguerre, and first exhibited by him in 1823. The particular advantage which this method possesses is, that it causes the light to play over the picture with an intensity graduated at will. The illusion is heightened by the transparencies, through which light is poured from behind the picture. The principle of the diorama has been successfully applied in producing some of the prettiest scenic effects of the modern stage.

**Diorite**, *dī'ō-rīt*, a rock consisting essentially of hornblende, biotite mica, and plagioclase feldspar that have a granitoid, or completely crystalline, texture. According to variations in composition, there are augite-diorites which grade into gabbros and quartz-diorites which grade into granites. The hornblende and augite-diorites are dark-colored; the quartz-diorites, light-colored. As augite changes readily to hornblende, many so-called diorites may represent altered diabases and gabbros; by further metamorphism the hornblende changes to chlorite. Diorites under shearing stresses may be changed into hornblende and chlorite schists. Andesites and dacites are rocks of the diorite family, but having a porphyritic texture. As compared with the syenites, diorites contain less potash and soda but more lime and magnesia, hence the principal feldspar is soda-lime. True diorites are

rare in the United States, though quartz-mica diorites and augite-diorites are not uncommon, and grano-diorites—the intermediate stages between diorite and granite—occur in great masses in the Sierra Nevada, in California. True diorites occur in various places abroad. One from Wales contains:  $\text{SiO}_2$  61.75;  $\text{Al}_2\text{O}_3$  18.88;  $\text{Fe}_2\text{O}_3$  0.52;  $\text{FeO}$  3.52;  $\text{CaO}$  3.54;  $\text{MgO}$  1.90;  $\text{Na}_2\text{O}$  3.67;  $\text{K}_2\text{O}$  1.24; and has a specific gravity of 2.79.

**Dioscoreaceæ**, *dī-ōs-kō-rē-ā'sē-ē*, a natural order of monocotyledonous plants, with alternate reticulate-veined leaves, tuberous rootstocks, and twining stems. The flowers are small and unisexual. There are nine genera, with about 175 species, chiefly inhabiting tropical America and South Africa. The typical genus is *Dioscorea*, which includes the yam of commerce (*D. sativa*). The best-known species in eastern America is the wild yam-root (*D. villosa*), which is found in moist thickets from Rhode Island north, south to Florida, and west to Texas. It ascends to 4,000 feet in the Virginia Mountains. The flowers are of a greenish-yellow bloom in June and July, and the fruit, which adheres to the vine until late in the winter, is ripe in September. *Tamus* (*Tesudinaria*) *elephantines*, a South African species, sometimes called elephant's foot, and Hottentot's bread, has a large fleshy rhizome, with a rough cracked bark, which is used as food by the Hottentots in times of scarcity.

**Dioscorides**, *dī-ōs-kōr'ī-dēz*, **Peda'nus**, physician: b. Anazarbus (Cæsarea Augusta), in Cilicia, in the 1st century A.D. He was author of a celebrated work on materia medica, in five books. It is particularly valuable in regard to botany, as most of the medicines which the author mentions are taken from the vegetable kingdom. Two other works are also attributed to him—the 'Alexipharmaca,' which was united with the 'Materia Medica,' forming the three last books of it, and treating of the poisons in the three kingdoms of nature, and their antidotes; and the 'Euporista,' which treats of remedies that are easily procured. The best edition of Dioscorides is that of Sprengel (1829-30).

**Dioscūri**, *dī-ōs-kū'rī*, the classical name for Castor and Pollux, twin brothers, and tutelary deities of wrestlers, horsemen, and navigators. Their transplantation to the sky as one of the 12 constellations of the zodiac (the Twins) is a celebrated allegory of mythology. They are sometimes styled Tyndaridæ, because Tyndarus was the nominal father of both.

**Dioscū'rus**, or **Dioscorus**, patriarch of Alexandria, immediate successor (444) of St. Cyril, was a supporter of the heresiarch Eutyches (q.v.). Pope Leo and Flavianus, patriarch of Constantinople, having condemned the teachings of Eutyches, Dioscurus procured from the Emperor Theodosius II. the convocation of a council of bishops at Ephesus in 449. To this council Pope Leo sent three legates as his representatives. Dioscurus was present, surrounded by a host of his satellites, and with their aid prevented the legates from presiding in the council and even from reading to the bishops the letters addressed to the assembly by Leo. Flavianus was so roughly handled by the rabble that he died shortly after in consequence of the injuries he received. The council thereafter got the title of Latrocinium (Brigandage) from the

Latins, and of Σύνοδος ληστρική from the Greeks (robbers' synod); but Theodosius upheld its decisions, and Dioscurus procured the appointment of one of his partisans, Anatolius, to succeed Flavianus in the see of Constantinople. After the death of Theodosius another council assembled at Chalcedon in 451, which annulled the decrees of the Latrocinium of Ephesus and decreed the deposition of Eutyches from his offices as presbyter and archimandrite.

**Diosma**, a genus of plants belonging to the rue family (*Rutaceæ*). They are small shrubs with white or red flowers; leaves alternate or opposite, simple. They are remarkable for their overpowering and penetrating odor, arising from the presence of a yellowish volatile oil. They are the buchu plants of the Cape of Good Hope. The plant has been employed in chronic affections of the bladder and urinary organs in general, and has also been administered in cholera.

**Diospyros**, a genus of plants belonging to the ebony family (*Ebenaceæ*). There are about 160 species, most abundant in Asia. They consist of trees and shrubs with white or pale yellow flowers. *D. lotos* is the Indian date-plum, and is supposed by some to be the lotus of the ancients. The trees of several of the species furnish ebony wood. The fruit of *D. kaki* is occasionally brought from China as a dry sweetmeat. *D. virginiana*, the American representative of the family, is the persimmon (q.v.).

**Dip**, in geology, the angle of inclination of any stratified rock to the horizontal of its bedding planes. In the same way the cleavage planes of any metamorphic rock are said to dip and a thin intrusion of igneous rock, a dike, has a dip. Also the contact plane of an igneous and a sedimentary rock may have a well-defined dip. The direction of the dip is the line of highest inclination and is expressed by compass bearing; thus a bed may dip 63° N., 35° E. The angle of dip is determined by an instrument known as a clinometer. Initial dip is the name given to the slight inclination away from the land that sedimentary beds have as a whole when laid down in the sea. Such initial dips are often of importance in determining flexures when the sediments are subsequently subjected to mountain-building pressures. See FAULT; FOLD; GEOLOGY; MOUNTAIN.

**Diphtheria** (Gr. *diphthera*, a skin, piece of leather, extended in meaning to comprise membrane), a contagious and (in its severe forms) malignant disease, caused by a specific bacillus, and generally characterized by the formation of a fibrinous false membrane in the throat. Although previously observed, it was first clearly described in 1826 by M. Bretonneau of Tours under the name of "diphtherite," as a form of very fatal sore throat occurring chiefly in children. It is now known that most cases of membranous croup are identical with diphtheria. The membranous inflammations of the throat occurring sometimes in scarlet fever and other infectious fevers may or may not be true diphtheria, a bacteriological examination being usually necessary to determine this point.

The period of incubation is usually from two to seven days. The disease begins by malaise, feeling of chilliness, loss of appetite, headache and more or less fever; soon the throat feels hot and painful and the neck is stiff and

tender. If seen early, the throat is red and swollen, but a false membrane of yellowish or grayish color quickly appears in spreading patches, usually first on the tonsils, whence it often spreads to the pillars of the fauces, uvula and back of the throat, and may even extend down the œsophagus or gullet; extension of the membrane into the nasal cavities is a grave symptom. There is usually enlargement of the glands at the angle of the jaw, and albuminuria generally occurs at some stage of the disease. Diphtheritic membrane may be formed on any mucous surface, or even on a wound; if it extends into the larynx it gives rise to cough and difficulty in breathing. The throat affection is often accompanied by a low and very dangerous form of fever, with quick, feeble pulse and great and rapid loss of the patient's strength, which is still further reduced by the inability to take food; in other cases, the disease is fatal by paralysis of the heart or by suffocation, due to invasion of the larynx. Invasion of the larynx may necessitate intubation or tracheotomy. After the acute disease is over, the recovery may be delayed by paralytic symptoms of various kinds; or simply by extreme debility with exhaustion and loss of appetite. In the early stages of convalescence there is danger of sudden heart failure upon exertion.

Diphtheria is contagious. It may occur as a complication of scarlet fever, measles, and other infectious diseases. All gradations in the intensity of the disease from mild sore throat to septic and gangrenous forms occur. Damp and temperate climates seem to favor its development. Insanitary conditions favor its occurrence, but the disease may appear under the most favorable hygienic surroundings. An important mode of its spread is by school children, either infected in a mild form or coming from households where the disease exists. One attack affords little or no protection against recurrence. In the treatment of the disease the patient should be isolated and all clothing and other articles which have been in contact with the sick, as well as the discharges, should be disinfected. Local applications to the diseased parts and means to maintain the strength of the patient were the most valuable therapeutic measures before the introduction of the antitoxin treatment.

True diphtheria is now known to be caused by a specific bacillus called *Bacillus diphtheriæ*, or the Klebs-Löffler bacillus. This bacillus was first recognized by Klebs in 1883 by microscopic examination of diphtheritic membranes, but it was first successfully cultivated by Löffler in 1884. Its causal relation to the disease was not thoroughly established till the investigations of Roux and Yersin in 1888, who demonstrated the existence of a peculiar and intensely poisonous substance known as the diphtheria toxin. It is now generally admitted that the Klebs-Löffler bacillus is the cause of true diphtheria. The diphtheria bacillus is a slender rod characterized especially by irregularities in shape and staining with aniline dyes. It grows best at about the temperature of the human body, and all growth ceases below 20° C. It can be cultivated artificially on various media, but best on a mixture of blood serum and beef-broth rendered solid by heating. In a moist condition the bacilli are killed in a few minutes by a temperature of 60° C. They survive for months in a dried condi-

tion. Exposure to the direct rays of the sun kills the bacilli in a short time. Guinea-pigs, when inoculated beneath the skin with a small quantity of a pure culture of the virulent diphtheria bacillus, die within two to five days with characteristic changes in the body. Skilled bacteriologists can recognize the presence of diphtheria bacilli in the throat by microscopical examination and the appearances in the cultures within 24 hours or less, but their complete identification may require the inoculation of a guinea-pig. Both in human beings and in animals the bacilli grow only or mainly locally in the false membrane, the severe constitutional symptoms being due to the absorption of a powerful poison secreted by the bacilli.

The ways in which diphtheria bacilli may be conveyed from sick to healthy persons are almost countless. In ordinary breathing the expired breath contains no germs, but in speaking and especially in coughing, a fine spray is emitted which may contain the bacilli and thus convey the disease. All sorts of articles, such as handkerchiefs, toys, drinking utensils, furniture, clothing, bed-linen, and the like, may become contaminated with the bacilli and be the means of spreading the disease. The specific germs have been found in the hair, on the shoes, and elsewhere on the persons of those brought into frequent and close proximity to the patient. Direct contact with the patient, as in kissing, may communicate the disease. It is especially through direct or mediate contact with infected individuals that the disease is spread. Hence, preventive measures, consisting in isolation of the patient till the bacilli have disappeared from the throat, and in thorough disinfection, are of the first importance in checking the spread of diphtheria. Insanitary conditions, formerly thought to be the direct cause of diphtheria, are now regarded only as accessory causes in affording opportunities for the prolonged survival of the specific germs or in weakening the powers of resistance of the individual.

The discovery of the diphtheria bacillus has led to the introduction of a new and most successful method of treatment of the disease, known as serum-therapy or the antitoxin treatment. The establishment of the principles and the introduction of this treatment are due especially to Behring of Germany and Roux in Paris. The underlying principle of the treatment is based on the fact that, if a susceptible animal is inoculated first with small and then with increasing doses of the toxin produced by the bacillus, the blood of the animal is found to contain a substance called antitoxin, which has the power of neutralizing or rendering harmless the toxin. In order to obtain large quantities of the healing serum a horse is generally selected for the process of immunization. By proper methods very powerful antitoxins can be obtained. The antitoxin is used not only to cure the disease, but also to render persons insusceptible for a time to the disease. This latter procedure of preventive inoculation has been found especially useful in preventing extensive outbreaks in children's hospitals and asylums after the introduction of one or more cases of diphtheria. Dr. William H. Welch, of the Johns Hopkins University, in 1895, in an analysis of over 7,000 cases of diphtheria treated by antitoxin found that the fatality was reduced by this treatment by over 50 per cent of the previous

death-rates; he concluded that the antitoxin serum is a specific curative agent for diphtheria, surpassing in its efficacy all other known methods of treatment for this disease. Since his report, this conclusion has been confirmed and even more favorable results have been obtained.

Some idea of the great benefits which have been derived from the discoveries outlined above may be had by comparing the death rate before and after the serum therapy became the practice. For the five years immediately preceding the discovery and use of antitoxin in the city of Berlin the death rate for diphtheria in every 10,000 inhabitants was 10.2 per cent, and for the next five years it fell to 3.7 per cent; in Paris, 6.5 per cent before antitoxin, and 1.3 per cent afterward; in New York 14.5 per cent before, and 6.3 per cent after antitoxin. So safe is the use of antitoxin, it is now advised that every child exposed should receive an immunizing dose, as that confers protection.

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**Diph'thong**, two vowel sounds, following one another so closely as to form but one syllable, as in out, where the sound is really composed of a and u. Many double vowels in English are not real diphthongs, there being only one sound heard, whereas some single vowels have a diphthongal sound. The only real English diphthongs are i as in high; i as in aye; oi in boil; ow in how; and ew in mew.

**Diple'gia**. See PARALYSIS.

**Diploblas'tica**. See EMBRYOLOGY.

**Diplococ'cus**. See BACTERIA.

**Diplodocus**, dī-plōd'ō-kūs, a saurian-footed, herbivorous dinosaur found in the American Jurassic deposits. The length of skull of this species was about 21 inches, of brain about 3 inches, and of body 50 feet. The animal is supposed to have been a hippopotamus-like wader, and to have lived on vegetation in the water.

**Diplo'ma** (Gr. *diploō*, "fold" or "double"), originally a document on two tablets of wax (see DIPTYCH), or on writing material which was folded. The Roman emperors granted diplomas to couriers, giving them the use of public servants and horses; hence diploma came to signify a writing or document conferring some power, authority, privilege, or honor, usually under seal and signed by a duly authorized official. Diplomas are given to graduates of a university on their taking their degrees; to clergymen who are licensed to officiate; to physicians, civil engineers, etc., authorizing them to practice their professions.

**Diplo'macy**, simplified, means political negotiation. Commonly applied the term refers to international relations and the adjustment of differences between nations. The principle objects of diplomacy have always been and are to-day to preserve the independence, rights and security of state and nation. Under diplomacy has been preserved the European "balance of power," the prevention of general wars and the securing of commercial advantages under treaty regulations. As a matter of fact all treaties are the result of diplomacy. In the past there have been many international and other conventions or congresses of diplomats, to preserve the peace

of the world and to settle differences of international moment. Such was the congress of Westphalia held in 1648, to settle the issues involved in the Thirty Years' War; the Congress of Vienna (1814-15); and the more recent Hague conference (1899) held at the instance of the Czar of Russia, for the promotion of the peaceful settlement of international differences among civilized nations. In the various countries, under modern methods and conditions, the usual instruments of diplomacy are: (1) the secretaries of state for foreign affairs; (2) regular diplomatic agents or representatives of various grade ranging from ambassadors to *chargés d'affaires* or consular agents; (3) special embassies and diplomatic agents or representatives appointed for the accomplishment of a particular purpose, as the case of the Alaskan Boundary Commission at London (1903). Prior to the 15th century diplomats were of the last named class. See INTERNATIONAL LAW. Also consult: 'A Hundred Years of American Diplomacy' (1900).

**Diplomat'ics, Diplomatic**, the science of deciphering ancient MSS., inscriptions, etc. See PALEOGRAPHY.

**Diplopia**, dī-plō'pī-ā, an affection of the sight in which objects are seen double. It arises from derangement of the visual axis.

**Diplop'terus**, a genus of fossil ganoid fishes, of four species, belonging to the Old Red Sandstone.

**Diploz'oon**, a parasitic trematode worm which infests the gills of the bream, and which appears to be formed of two distinct bodies united in the middle, and resembling an X or St. Andrew's cross, two sexually mature individuals being thus united. The larva, formerly called *Diporpa*, swims about in the water for a time, but ultimately settles in the gills of a fish, where it remains during the rest of its existence. The larvæ then unite in pairs by the attachment of the ventral sucker of one individual to a knob on the back of another.

**Dip'noi**, one of the primary subdivisions of fishes, characterized by the presence of membrane or covering bones on the skull, the absence of secondary bony jaws (maxillary, premaxillary, and dentary bones), and the direct articulation of the lower jaw with the skull. The *Dipnoi* were early predominant in geological times, many and varied forms occurring as fossils in the Middle and Upper Palæozoic strata. Some of these, forming the order *Arthrodira*, are of doubtful relationship, and are classed with the *Dipnoi* only provisionally. The best-known representatives of this group have the anterior region of the body enclosed in continuous bony plates, with a complex articulation between the head and trunk. In the Devonian of Ohio are found giant forms, like *Dimichthys* and *Macropetalichthys*, from 10 to 25 feet long, and with sharp-beaked jaws like a turtle's. Numerous other *Dipnoi*, more closely resembling the still living ones, have been found as fossils in various parts of the world. At the present time the group is decadent, and but three genera and as many species, each found in a restricted area in widely separated regions of the earth, remain. They are, *Protopterus* from Africa, *Lepidosiren* from South America, and *Ceratodus* from Australia. On account of the lung-like structure of

the swim-bladder and its function as an organ of respiration, they are known as lung-fishes. Being the earliest vertebrates which are believed to have breathed air, the *Dipnoi* have an exceptional interest, and many zoologists consider them to have been the original stock from which the *Amphibia* and all other terrestrial vertebrates arose. Consult: Dean, 'Fishes, Living and Fossil.'

**Dippel, Johann Conrad**, yō'hän kōn'rād dīp'pēl, German mystic and alchemist: b. Frankenstein, near Darmstadt, 10 Aug. 1673; d. Berleburg, Prussia, 25 April 1734. He led a wandering life for many years, involved in difficulties political and theological, and he finally wrote a tract which appears to have ruined him with all parties, and to have provoked replies in the same spirit as that in which the attack had been made. He now fell in with some alchemical books, and at once threw himself into the search for the philosopher's stone. In this also he was assisted by others, who hoped to profit by the discovery, but when no result was obtained, and the money was not forthcoming, Dippel retired to Berlin, where he induced some persons of rank and wealth to help in the search. During his residence here he produced what is known as Dippel's Oil (q.v.), from which followed indirectly that of Prussian blue—an accidental discovery, it is true, but one of a class that could hardly have been made but for the constant and multifarious, though not well-directed labors, of such men as Dippel.

**Dip'pel's Oil**, the black fetid oil which was formerly produced by the distillation of stag's horn or ivory, and was used medicinally. Dippel, in the 17th century, refined it by washing with lime or potash, and rectifying the oil until it became limpid and aromatic. This rectified oil was the *oleum animale Dippelii* of the older pharmacopœias, which was prescribed in doses of a few drops as an antispasmodic and diaphoretic, and as a hypnotic.

**Dipper**, a name given to the seven stars in the constellation of the Great Bear, from their being arranged in the form of a dipper, or ladle.

**Dipper**, a water-ousel. See OUZEL.

**Dipping-needle**, or **Inclination Compass**, an instrument for measuring the magnetic dip or inclination; that is, the angle which a magnetized needle, free to move in the plane of the magnetic meridian, and about a horizontal axis, makes with the horizontal plane at the place. The dipping-needle is a light magnetized steel bar supported on a horizontal axis which passes, as nearly as possible, through the centre of inertia of the bar. The axis is either a steel knife-edge which rests on agate plates, or a fine wire supported by friction-rollers. A vertical circle surrounds the needle, the axis on which the needle turns being at the centre; the circle is graduated, and the needle moving over the graduations, the inclination to the horizon can be read off by means of it. The vertical circle is mounted on a vertical pillar, which turns round its own axis; and to the pillar there is attached at the foot an arm or pointer, which moves over a horizontal graduated circle. This last is supported on three legs furnished with leveling screws.

## DIPROTODON — DIPTYCH

To observe with the dipping-needle the vertical circle must be placed in the plane of the magnetic meridian, and then the angle at which the needle is inclined must be read off by means of the graduations on the circle. The plane of the magnetic meridian might, of course, be determined by means of a separate instrument, such as the declination compass (q.v.). But this is not necessary, the vertical pillar and horizontal circle described above furnishing all that is required. A complete observation is made in the following way. The instrument having been properly leveled, the vertical circle is turned round on the pillar till the needle points vertically downward. When this is the case we know that the needle must be moving in the vertical plane at right angles to the plane of the magnetic meridian, because it is only in this plane that there is no horizontal component of force acting on the needle. The vertical circle is now turned round on the pillar through 90 degrees, which is done exactly by means of the horizontal circle at the foot. The needle is thus free to move in the plane of the magnetic meridian, and the inclination is read off.

Corrections for defects in the instrument must be applied in order to make the determination exact. In the first place, in order to correct for any error in centering of the axis on which the needle turns, readings are taken at both ends of the needle. Next, because the magnetic axis of the needle may not coincide with the axis of the figure, the needle is turned over on its bearings, and fresh readings are taken. Thirdly, the axis on which the needle turns may not pass exactly through the centre of inertia of the needle. If this were the case the needle would not balance about the axis exactly, one or other end of it being the heavier. To do away with error from this source, after one set of readings have been taken, the needle is lifted from its bearings and remagnetized, the end that was formerly north being now made the south end. A complete new set of readings is taken. The mean of all these gives the true inclination. See DECLINATION NEEDLE; MAGNETISM, TERRESTRIAL.

*Diprotodon*, di-prō'tō-dōn, a huge extinct marsupial of the Pleistocene Period in Australia. Its nearest living relatives are the wombats and kangaroos, which it somewhat resembled in the character of the head. The animal was by far the largest of the marsupials, almost equaling a small elephant in size, and resembling the elephants in its rather long legs and short post-like feet. The structure of the foot-bones is very remarkable; the great toe is short and stout, the others reduced to small slender rudiments. Its remains have been found in great abundance in certain dried-up salt lakes (Lake Callibona, etc.) of the central Australian deserts.

*Dip'sacus*, the typical genus of the *Dipsacaceæ*. See TEASEL.

*Dip'sas*, a genus of tropical opisthoglyph serpents, mostly tree-snakes with greatly elongated bodies and protective coloration, which are usually nocturnal, and feed mainly upon lizards and birds and their eggs, though some species pursue mammals and other birds exclusively. Their posterior poison-fangs (see OPISTHOGLYPHA) are large, but they differ in venomous

ability, which is rarely deadly to a large animal. This and several allied genera form the colubrid sub-family Dipsadinae.

*Dipsoma'nia*. See ALCOHOLISM.

*Dipsosaurus*, dip-sō-sâ'rūs, a reptilian genus of the family *Iguanidæ* (plurodont lizards), whose habitat is confined to the warmer parts of the United States. The genus contains but one species, *D. dorsalis*, which is terrestrial in its habits. When alarmed, it raises its head and tail and glides swiftly to its burrow in the sand.

*Dip'tera*, an order of two-winged insects, of which the common housefly and bluebottle are familiar examples. They are characterized by a body with slight coriaceous coverings, a trunk open beneath, and containing a sucker composed of two, four, or six lancet-shaped elongated scales, two palpi, antennæ almost always composed of three joints, large eyes, an abdomen of four to seven distinct segments, tarsi with five joints, and two short clubbed appendages called *halteres* or balancers, which seem to be the rudiments of the posterior pair in four-winged insects, and are kept in continual motion. They all undergo a complete metamorphosis. They are found in the earth, the air, and the water, in all climates and in all localities. The far greater number live exclusively on the sap of flowers.

*Diptera'ceæ*, or *Dipterocarpeæ*, an important order of exogenous trees. They are found in India, and especially in the eastern islands of the Indian archipelago. There are about 8 genera and 48 species known. The trees belonging to this order are handsome and ornamental, and abound in resinous juice. When young, the *Dryobalanops camphora* yields, on incision, a pale yellow liquid, consisting of resin, and a volatile oil having a camphoraceous odor; when old, it furnishes a kind of crystalline camphor. Other species produce fragrant resins used in temples, also varnishes; while some of the commonest produce pitches, and valuable timber.

*Dip'terus*, a fossil fish occurring in the Devonian rocks, and belonging to the Dipnoi sub-class, family *Dipteridæ*, of which this is the typical genus. Its distinguishing character is the possession of double dorsal and caudal fins. An interesting fact connected with it is that it approaches nearer to the lung-fishes than do any of the present existing ganoids.

*Diptych*, dip'tik, a tablet consisting of two leaves, light boards, held together by a hinge. In the time of the Roman empire diptychs were much used in correspondence between friends; even when three boards or more were used the name diptych (*Sintoxos*, folded double) was generally retained instead of triptych, tesseraptych, etc. Diptychs figure largely in the history of the Church for several centuries, being tokens of intercommunion between the assemblies of the faithful throughout the world. The use of diptychs in the liturgical service was in full vogue in the middle of the 4th century and it must have commenced much earlier. It was continued in the Latin Church to the 12th century and in the Greek Church to the 15th. The Diptychs of the Living had inscribed on them the names of the pope, patriarchs, bishops then living and presiding over the faithful in their respective spheres; also the names of the clergy of the particular churches in which they were



kept; names also of benefactors of the churches, of the emperor, and the empress, etc. For all these the faithful offered their prayers. The Diptychs of the Dead contained usually the names which had once been written in the Diptychs of the Living. In the diptychs were also inscribed the names of the Virgin Mary, martyrs, and other saints. If any name, whether of the living or the dead, was erased from the diptychs of a church, that erasure signified that the person was regarded as out of the communion of the Church. The diptychs both of the living and dead were read from the *ambo* or pulpit to the congregation. Church calendars and martyrologies seem to have had their origin in the diptychs. In the Roman Missal, the marks of the diptychs are very evident. At the prayer, "Te igitur," the names of the reigning pope and the bishop of the diocese are mentioned. In other prayers of the Mass the diptychs are followed. Consult: Kraus, 'Real—Encyclopädie'; Benedict XIV., 'De Missa.'

**Dipus.** See **JERBOA**.

**Dique**, *dêk*, **Canal del**, Colombia, an "artificial arm" of the Magdalena River in the department of Bolívar. It is navigable by steamers, and is a means of communication between Cartagena and the interior of the republic. Its total length is about 74½ miles, and in its course it passes through several swamps and receives the waters of various conduits, reaching the coast south of Cartagena.

**Diræ**, *dî'rê*, or **Eumenides**. See **FURIES**.

**Dirce**, *dêr'sê*, in Greek legend, the second wife of Lycus, king of Thebes, who from jealousy imprisoned Antiope, whom Lycus had divorced in order to marry herself; but Jupiter set Antiope at liberty, when she soon gave birth to two sons, Amphion and Zethus. These latter having grown up, put Lycus to death, and attached Dirce to the tail of a wild horse, which dragged her over the rocks, on which she was dashed to pieces. The gods, pitying her misfortunes, changed her into a spring, which bears her name and flows near Thebes.

**Dircks**, **Henry**, English civil engineer: b. Liverpool 26 Aug. 1800; d. Brighton 17 Sept. 1873. He published: 'History of the Search for Self Motive Power' (1861); 'The Ghost as Produced in the Spectre Drama' (1863); etc.

**Direct and Retrograde**, terms which, when used in astronomy, have reference to the real or apparent motion of the planets. When the planet moves forward or appears so to move, from west to east, in accordance with the order of signs in the zodiac, the motion is said to be direct. When the motion appears contrary it is said to be retrograde.

**Direct Taxes**, those which in theory the bearer cannot transfer to others, by adding correspondent charges to goods or service; as distinguished from indirect, those on goods for sale, which will be added to their selling price. The former in current understanding include taxes on polls, property, incomes, and privileges—that is, fees and licenses for doing business, keeping pets, carriages, etc. But the Supreme Court of the United States, in the income-tax cases, decided that only taxes on polls and property are direct; which is law for this country. The theory at best does not quite

conform to facts. Taxes on real estate occupied by the owner, for example, are not transferable; but those on property for rent are so much added rent charge, and as indirect as customs duties. The heavy license fees charged by many municipalities for doing certain classes of business are *pro tanto* an increase of the business expense, and must be met in the charges if the business is to live; often, indeed, they are used openly as "protective," to give industries of one State an advantage over others—this is especially so with insurance companies. On the other hand, income taxes on salaries cannot in practice be transferred, as an employer will not raise salaries on account of his employees' taxes; while those on mercantile incomes are in the same category as those on licenses, and can to some extent be recouped from customers. All State and municipal revenues in the United States are raised from direct taxes in the broader sense; the Constitution prohibits them from laying duties on exports or imports, but not on internal manufactures, which, however, are also left entirely to the general government. The latter restricts itself to customs and excises. Only five times in its history has it resorted to direct taxation, in the narrower sense above: in 1798, 1813, 1815, and 1816, on real estate and slaves; and in August 1861 a levy of \$20,000,000 for war expenses was laid on all house lots with dwellings and improvements. The operation of the act was suspended 1 July 1862, when \$15,000,000 had been collected; and the act of 2 March 1891 refunded it to the States.

**Directors**, the persons authorized to manage and direct the affairs and business of a corporation or company. The directors are sometimes called managers or trustees, in accordance with the purpose and nature for which the corporation or company was formed. At the present time, nearly if not all, corporations are formed under general laws and it depends on the law under which the corporation is created as to the number of directors and their qualifications. The general qualification is that all directors must be stockholders in the corporation or, if it has no stock, they must be members of the corporation. The directors are generally elected by the stockholders, and some States have passed laws allowing cumulative voting, by which each stockholder may multiply the number of his shares by the number of directors to be elected, and cast all his votes for one director or distribute them in any manner he desires. It has been held that this kind of a law is unconstitutional, if applied to corporations created before the law was passed; as it impairs the obligation of the contract. It may be valid, if applied only to corporations created after the passage of the act. In some cases directors are appointed. The directors must act as a body and not as individuals. A majority of the board of directors is necessary to a legal meeting and if that number is present a majority of those present will be sufficient to perform any act. When there is a quorum present, all acts performed are presumed to be done in the regular course of business. The directors for the purpose of the business of the corporation are held to be the corporation itself; and their powers and duties depend on the laws under which the corporation is formed and the charter and by-laws



## DIRECTORY

of the corporation. Notice to the board of directors during a meeting of any matter in which they are required to act is notice to the corporation.

The directors are considered as general agents of the corporation, and they are the only ones that can manage the business of the corporation; although the directors are generally elected by the stockholders they are responsible to the corporation and through the corporation to the stockholders. As the directors derive their power from the charter their acts are of no effect if they are outside of the delegated power; and all acts performed by the directors which are outside of their power must be passed upon by the stockholders.

While directors are sometimes called trustees, they are not held to the same strict accountability as an ordinary and regular trustee; although their position is a fiduciary one. The directors may deal with the corporation the same as any other individual; but they cannot use their position for any special benefit to themselves. They may even go so far as to buy up the indebtedness of the corporation and at a sale buy in and acquire the absolute title to the corporate property. The directors may delegate their power to an agent, as a private individual may do, and the agent's power is not impliedly revoked by a change of the members of the board, as the act of appointment is not that of the directors individually but of the board. The directors have a discretionary power and when it is honestly exercised there is no one that can make them account for their acts. A frequent illustration of this power is in relation to suit by or against the corporation, as to whether they shall be brought or defended. If a director's individual interests are in conflict with the interests of the corporation the act must be fair and just to the corporation.

**Directory**, a compilation of the names and addresses of the persons in a city, or in a special line of trade, or the like. The first directory of the city of London was issued in 1677, under the title 'A Collection of the Names of Merchants,' and the first New York directory in 1786, the latter containing less than 1,000 names. The London directory of 1732 is believed to be the first which bore the title "directory." Every American city of moderate size now has its directory, and many directories of towns and counties are issued. There are also a few State directories, and a great number of business directories, arranged according to the needs of the respective localities. Directories of firms in each of the leading lines of trade are issued regularly, often in connection with some sort of commercial rating. Directories of people in society are commonly termed blue books. Telephone companies also issue directories of their subscribers.

City directories constitute the most important class of these publications, and are commonly issued by private enterprise. The concern that issues the first directory of a town or city, and continues to issue the same at regular intervals, usually yearly, soon establishes a sort of franchise, which enables them to control that field as long as they issue a satisfactory book. There are a number of firms in the United States whose sole business is publishing directories, and they have acquired

territory by being the first in their respective fields. As a rule they do not compete with each other in the same territory, for even in very large cities a second directory rarely pays.

The gathering of names and addresses for a directory, when rightly done, is an expensive matter, involving a house-to-house canvass of the entire territory, within a short space of time. Sometimes the work is cheapened by the copying of assessors' lists or lists of voters, but the great majority of directory publishers find that the best way is to make their own canvasses yearly. To protect themselves against the competition of firms that might simply copy the book and thus compete with them at a much reduced cost, all experienced directory publishers now insert a number of bogus names and addresses in their books, which are copyrighted. While a competitor would have a right to issue another correct, and therefore very similar, book without infringing the copyright, the fact that he copies these bogus names is direct evidence of infringement, calculated to result in a judgment of damages to the injured party.

The mere placing of names in alphabetical order for a directory seems a simple matter, yet in reality it involves considerable care and judgment. Take the names "McNeil" and "MacNeil" for instance. If they are separated, a person searching in the directory under one spelling might miss the other altogether. As it is generally understood that "Mc" is simply an abbreviation of "Mac," the directories now commonly begin the lists of M's with the "Mcs," which ever way they are spelled, allowing such names as "Madison" and "Magee" to appear farther on. The location of such names as begin with figures also calls for discretion, as when it is desired to insert "1st Ward Republican Club." Such an entry is usually put in the f's, even if "1st" is the authorized way of spelling it.

The profit in directories is mainly in the advertising, and few of them would be issued simply for the sake of the sale. The number of firms that buy them is naturally limited to successful business concerns whose business requires frequent reference to a directory. Drug stores habitually carry copies on their counters for the benefit of the public, and many banks and newspaper offices have copies in their offices placed conveniently for the use of customers.

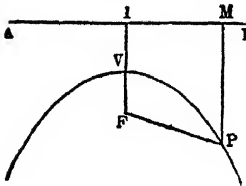
The advertising in the directory of a large city commands a high price, and yields large returns. It is customary to place the advertising on the margins of the leaves of the directory, and almost all over the cover, as well as the edges of the book. No available spot is considered sacred from such intrusion, as is the case with most newspapers and magazines. Any man or firm that will pay for it can have his or their name inserted in as big type as desired, or secure conspicuousness in any other way that ingenuity can suggest.

At the present time the directory field of industry in the United States appears to be rather crowded, and many directories are published not for immediate profit, but simply to hold a field until it shall grow large enough to be profitable. A few years since an association of directory publishers was formed, which holds annual meetings, and endeavors to check unwise competition, and to conserve the interests of the trade as a whole.

## DIRECTORY — DISCIPLE

**Directory**, in French history, the executive body established by the constitution of the French republic in 1795. (Fr. *directoire*.) This body consisted of five members, called directors (*directeurs*) who were chosen by the Council of Elders from candidates presented by the Council of Five Hundred. Each director was president for three months in rotation, and one was compelled to make room for a new member every year. The unpopularity of the directory's home policy was increased in 1799 by the disastrous results of its war policy, and it was easily overthrown by the *coup d'état* of Napoleon and his brother Lucien, 9 Nov. 1799. See FRANCE.

**Diréc'trix** (Lat. *linea directrix*, "a directing line"), in mathematics, a line governing the direction of another line. If a point so move that its distance from a given fixed point is to its perpendicular distance from a fixed straight line in a constant ratio, it describes a conic section, of which the fixed straight line is termed the directrix, and the fixed point the focus. The constant ratio referred to is termed the eccentricity, and its magnitude determines the nature of the conic. Thus, if in the figure AB be the directrix and F the focus, if the point P move so that its distance from F is to its distance PM from AB in a constant ratio, then P will trace out a conic section, which will be an ellipse, parabola, or hyperbola, according as the ratio in question is less than, equal to, or greater than unity—that is, as FP is less than, equal to, or greater than PM, or FV than VI. A quadric surface has a directrix with analogous relations. The fixed lines on which rests the line whose motion, right or curved, generates a surface, are called directrices, or directing lines.



**Dirhem**, *dér'am*, or **Dramm**, a modification of the Greek *drachma*, the name under the caliphs for a weight of silver equivalent to about 45 grains, and was also used for precious stones and medicine in Arabia, Persia, Egypt, and Turkey. As a coin the value varied, but may be given at 11 cents under the caliphs. In Turkey, the name dirhem has lately been given to the much smaller weight, the French gramme.

**Dirk**, a kind of dagger formerly carried sheathed between skin and stocking as a weapon by the Highlanders of Scotland. Dirks are worn by midshipmen and cadets of the British navy. See DAGGER.

**Dirk-Hartog** (*dérk-här'tög*) **Island**, an island on the west coast of western Australia, at one of the entrances to Shark Bay, which it partly encloses; area, about 450 square miles. It forms a plateau with good pastures and plenty of water. The pearl oyster and edible oysters are here in great abundance.

**Dirschau**, *dér'show*, Prussia, city, about 19 miles southeast of Danzig, on the Vistula. The city has railroad and machine shops, and large sugar works. Pop. 12,000.

**Dirt-eating**. See GEOPHAGISM.

**Dis** (also **Orcus** and **Tartarus**), in Roman mythology the name given to Pluto, the Greek

god of the lower regions. The word *dis* is akin to *divus*, and originally denoted merely godhead.

**Disability**, in law, when absolute disables the party from holding public office or doing any legal act, and is usually the result of murder, outlawry, or any outrage upon person or property. Aliens, infirm and aged persons, dependent on public charity, are under this ban of incapacity, and in most Catholic countries those individuals who have been excommunicated. There is a disability termed partial that covers infancy, minority, lunacy, and drunkenness. Also a term in accident insurance policies which, on account of inability to work or perform natural duties resultant from injuries, provides payment for the afflicted party. See ATTAINDER.

**Disassociation**. See DISSOCIATION.

**Disbar'ment**, the expulsion of an attorney, counselor, or advocate from practice at the bar, this act depriving him of the privileges of his profession. A lawyer suffers this penalty if adjudged guilty of any misconduct of grave nature, as gross contempt of court, bribery, etc. The courts alone have this power of dealing with a man. Before disbaring him the accused is given every opportunity to refute the charge, being allowed to defend himself in open court. A lawyer so dealt with may, at the discretion of the authorities, be restored when sufficient proof is brought them that there is no likelihood of a future offense.

**Discharge**, in architecture, the relieving part of a wall, or a beam or other piece of timber, from the superincumbent weight by means of an arch thrown over it. In hydraulics, the issuing direction of water from a reaction or turbine wheel; as the outward discharge, or Fourneyron turbine; the vertical discharge, or Jonval turbine; the centre discharge, etc. In bankruptcy, a writing or document certifying that a bankrupt has satisfactorily passed the necessary forms, and is thereby discharged from all further responsibility for the debts contracted by him previous to his bankruptcy. In the military and naval services, a document given to each soldier or sailor on his dismissal from or quitting the service, in which are detailed full particulars as to his length of service, conduct, reason for discharge, etc. In electricity it signifies the removal of the charge by communication between the positive and negative surfaces or poles, or with the earth.

In dyeing, a substance such as chloride of lime or nitric acid, used by calico-printers to remove a color. Suppose a white pattern is to be produced on a uniformly colored ground. The cloth is first dyed, and then the pattern is printed with an acid, such as the tartaric, thickened with gum. When passed through a dilute solution of bleaching-powder, the acid decomposes it, and the liberated chlorine destroys the color at the parts where the pattern was printed. Sometimes the cloth is prepared at the same time for subsequent pigment printing.

**Disciple**, literally, one who learns anything from another; and hence, the followers of any teacher, philosopher, or head of a sect. In this sense the word is sometimes used in Scripture, as when we read of the disciples of Moses, of John, of Christ. Generally, however, it is used with reference to the last of these—the followers of Jesus. Sometimes all who re-

## DISCIPLES OF CHRIST

ceived the doctrines of Christ are called disciples, but in a more limited sense, it is applied to the 70, or 72, persons who were his more immediate followers and attendants. Sometimes it is used as synonymous with apostle, and is applied to the Twelve.

**Disciples of Christ.** The religious movement, whose representatives have come to be known as Disciples of Christ, or Christians, may be said to date its origin from the 'Declaration and Address' issued by Thomas Campbell, September 1809, and endorsed by his son, Alexander Campbell, who later became the leader of the movement. Thomas Campbell migrated from the northern part of Ireland in 1807, to seek a home for himself and his family in the New World. He located near Washington in western Pennsylvania. He was related by blood to the poet, Thomas Campbell, and was a man of learning and profound piety. Being a minister in the Seceders' branch of the Presbyterian Church, he entered upon his labors in connection with that denomination immediately upon his arrival in this country. His experiences in seeking to assemble the scattered people of God of different names and creeds, and to instruct them in spiritual things, led him to realize more fully the evils of divisions among Christians. In his efforts to promote greater unity and co-operation among the members of these different sects, he found himself in conflict with the ecclesiastical authority under which he was working and was brought to trial before his presbytery, which censured him for his course. Mr. Campbell soon withdrew from the ecclesiastical authority under which he had been preaching, but continued his ministry to an increasing number of people in private dwellings and wherever else an audience could be gathered.

In the 'Declaration and Address' referred to it was declared that "the Church of Christ upon earth is essentially, intentionally, and constitutionally one, consisting of all those in every place that profess their faith in Christ and obedience to Him in all things according to the Scriptures, and that manifest the same by their temper and conduct; and of none else, as none else can be truly and properly called Christians." While admitting the necessity of "distinct societies, locally separate one from another," this new declaration of independence declared that "there ought to be no schisms, no uncharitable divisions among them. They ought to receive each other as Jesus Christ also received them, to the glory of God, and for this purpose they ought all to walk by the same rule; to mind and speak the same things, and to be perfectly joined together in the same mind and in the same judgment." The address adds that "in order to do this, nothing ought to be inculcated upon Christians as articles of faith, nor required of them as terms of communion, but what is expressly taught and enjoined upon them in the Word of God. Nor ought anything to be admitted as of divine obligation in their church constitution and management but what is expressly enjoined by the authority of our Lord Jesus Christ and his apostles upon the New Testament Church, either in express terms or by an approved precedent."

In a word, the new movement had for its aim no less an object than the unity of Christians as they were one in the apostolic Church. In order to realize this consummation in harmony

with the Lord's intercessory prayer they decided to reject all party names for those given in the New Testament, and all human creeds or formulas as authoritative or binding on the human conscience, or as bases of fellowship, and to take the word of God alone as their rule of faith and practice, and especially the New Testament, which was given for the guidance and instruction of Christians in their new life in Christ. Believing it to be necessary to return to the original foundation and practice of the Church in order to realize its unity and its power, they made a fresh study of the New Testament to ascertain (1) what was the essential creed or confession of faith required in the early Church; (2) on what conditions persons were received into its membership; and (3) what was the nature of their organization and government. They reached the conclusion that the confession of faith made by Simon Peter, on which Jesus declared he would build his Church, namely "Thou art the Christ the Son of the living God," was the creed of Christianity and the essential faith, and that all those who would make this confession from the heart, being penitent of their past sins, were to be admitted by baptism into the membership of the Church; that baptism in the early Church consisted of the burial of a penitent believer in water in the name of the Father, and of the Son, and of the Holy Spirit, and that only such were fit subjects for baptism; that the form of Church government was congregational; that each congregation had its deacons and elders or bishops, the former to look after the temporal, and the latter the spiritual interests of the Church. The Lord's Supper, it was found, was observed at first daily perhaps, but later weekly, on the first day of the week, in remembrance of Christ's suffering and death. Hence they practice weekly communion.

With this plea for the New Testament basis of fellowship, and a return to the original purity and simplicity of the gospel and Church organization, the Disciples have made a marvelously rapid increase. The movement at present has reached a numerical strength of 1,250,000, having its colleges, its religious journals, and its missionary, educational, and benevolent organizations, all of which are doing effective work. The American Christian Missionary Society is the national organization for home missions. The Foreign Christian Missionary Society, as its name indicates, has for its object the evangelization of the world. Besides this the Christian Woman's Board of Missions is an organization of the Christian women, which is doing mission work in both the home and foreign fields.

The Disciples of Christ raised over \$600,000 for missionary purposes in 1902, while contributing a grand total of over \$6,000,000 for all religious purposes in that year. They are supporting missions in India, China, Japan, Africa, the Philippines, Cuba, Porto Rico, Mexico, Scandinavia, and Turkey. Their aim is to be evangelical without being sectarian, and to be liberal without being latitudinarian. They attribute their success to their advocacy of Christian union, the simplicity and directness of their preaching and the freedom which they enjoy, untrammelled by human creeds or by any hierarchical authority.

## DISCIPLES OF CHRIST — DISCOBOLUS

The following statistics are taken from the annual official report for 1902:

No. Churches.....	1902
No. Communicants.....	10,957
No. Bible Schools (Sunday Schools).....	1,207,377
No. Scholars, Officers and Teachers.....	8,271
No. Ministers.....	796,699
	6,477

### MISSIONARY.

Foreign Christian Missionary Society.....	\$178,324
Christian Woman's Board of Missions.....	139,034
American Christian Missionary Society.....	82,931
Board of Church Extension.....	54,866
State and District Missions.....	154,059
Miscellaneous Missions.....	15,000—\$ 624,214

### EDUCATION AND BENEVOLENCE.

Buildings and Endowments of Schools.....	\$175,000
Homes for Orphans, the Aged, etc.....	72,332
Ministerial Relief.....	7,421—\$ 254,753

### LOCAL CHURCH WORK.

Ministerial Support.....	\$3,665,000
Incidental Church Expenses.....	760,000
Church Buildings.....	550,000
Church and Bible School Literature.....	340,000—\$5,315,000
Total from all sources.....	\$6,193,967

J. H. GARRISON,

*Editor The Christian-Evangelist.*

**Disciples of Christ.** See CHRIST, DISCIPLES OF.

**Disciplī'na Arca'ni**, the modern name of an ancient usage of the Christian Church in withholding from pagans, and even from catechumens during their preparation for admission to baptism, the knowledge of certain of the Church's doctrines. The existence of this rule of silence in the Church in the 4th century is shown by the Catecheses of St. Cyril (q.v.) of Jerusalem, where the lectures on the sacrament of the Eucharist are deferred till after the catechumen had been baptized. He was then made acquainted with the *catechesis mystagogica*, or mystic catechism. Sometimes in that age when the sacred mysteries had to be referred to in a mixed assembly of believers and pagans, or in writings addressed to pagans, the fathers would use forms of speech quite unintelligible to the uninitiated, adding, "the believers will understand." On one occasion St. Epiphanius alluded to the sacramental words of institution of the Eucharist, "This is my body" in this cryptic fashion, saying instead of τοῦτό ἐστιν τὸ σῶμα μου, τοῦτό μου ἐστι τὸδε. And St. John Chrysostom writing to Pope Innocentius about the profanation of the Sacrament on a certain occasion, writes plainly: "The most holy blood of Christ was spilled upon the clothes of those soldiers." But Palladius, in his life of Chrysostom, uses a cryptic form of language to denote the same occurrence; his words are: "They spilled the *symbola*." St. Paul is quoted as enjoining a like reticence where he writes to the Corinthians that he fed them with milk, not with strong meat, because they were not able to bear it. Testimonies of the ancient fathers concerning the existence in their times of the *disciplina arcani* are numerous and, says Newman, "that it existed even as a rule with respect to the Sacraments, seems to be confessed on all hands."

**Discipline**, in military and naval affairs, the general term applied to the prescription and enforcement of statutes, rules of procedure, orders, and regulations governing officers and men

in service. Regimental discipline is chiefly maintained by the adjutant. He inspects and tells off all guards, escorts, and parties; keeps the regimental books; receives all garrison orders; superintends the drill and field movements, etc. In matters of discipline the adjutant-general is to the whole army what the adjutant is to a regiment.

**Discipline, Books of**, two books connected with the Scottish Church. The First Book of Discipline was drawn up by John Knox and four other ministers, and laid before the General Assembly in 1560. It was also submitted to the privy council; and though not formally ratified by them, it was subscribed by the greater part of the members. A similar document, called the 'Second Book of Discipline,' was prepared and sanctioned by the General Assembly of 1578; and from that time it has been recognized as the authorized standard of the Church of Scotland in respect of government and discipline. It lays down principles regarding the relations of Church and state; defines the provinces, duties, and relations of church-officers, the mode of their election, etc., and states the operation of the Presbyterian polity in the General Assembly, synods, and presbyteries of the Church of Scotland.

**Discipline, Ecclesiastical**, the control and correction which ecclesiastical bodies claim the right to exercise and administer for the purpose of maintaining correctness of living, and soundness of belief among their members. The only form of discipline at present exercised over contumacious lay members of a religious body consists of excommunication, or exclusion from a share in the ministrations and offices of the Church. The clergy, on the other hand, are liable to suspension or deposition; the former a temporary, the latter a perpetual, deprivation of office and authority. For methods by which the civil power was authorized by the Church during the Middle Ages to discipline heretics or notorious evil doers, see INQUISITION.

**Disclaimer**, in equity, a plea put in on the part of a defendant in which he disclaimed all right or title to the matter in demand by the plaintiff's bill. In patent law, disclaimer is the renunciation or relinquishment of all claim to patent rights in an invention. The term is also applied to the refusal to accept a gift or devise of land or other property, and generally to the waiving of any claim.

**Dis'co**, an island on the west coast of Greenland, under the parallel of 70° N. It is mountainous, reaching a height of 3,000 feet; about 90 miles in length; and contains much excellent coal. The harbor of Godhavn is on the south coast.

**Discob'oli**, Cuvier's name for the lump-suckers (*Cyclopterus*), beside which he placed the *Remora* (q.v.). The term is still used for the family to which the lump-sucker (q.v.) belongs.

**Discob'olus**, (1) in classical antiquity, a thrower of a discus, or quoit; a quoit-player; specifically, the name given to the famous Greek statue of the quoit-thrower, preserved among the Townley Marbles in the British Museum. (See DISCUS). (2) In ichthyology a name given by Cuvier to his third family of soft-finned teleostean fishes, having the ventral fins under the

pectoral. The name is derived from the ventral fins forming a disk on the under surface of the body, by which the fishes are enabled to catch hold on the points of rocks.

**Dis''comedu'sæ.** See JELLYFISH.

**Discoph'ora.** See HIRUDINEA; LEECH.

**Discord** (Latin *discors*, inharmonious), in music, is a combination of sounds producing irregular vibrations and technically called cacophony. It is a direct violation of harmonic laws and frequently spoken of as nothing but downright noise. Often confused with dissonance (q.v.) which, however disagreeable the effect it has upon a hearer, obeys certain grammatical rules in the science of music, though never consonant. Celebrated composers have used discords purposely in their compositions requiring *macabre* character. Berlioz in his 'Damnation of Faust' is a case in point, while Wagner's scores bristle with cacophonies and dissonances.

**Discount** (O. F. *discontes*, to count off), a deduction made from a quoted price, in consideration of a cash payment. Discount is also the amount deducted from the face value of a bill of exchange or promissory note, as the price for cashing it to the payee so many months or weeks before it is payable by the person who is primarily responsible for its payment. Bank discount is simple interest on the face value of a promissory note, and deducted from the face value, instead of being reckoned on the amount advanced. True discount is such an amount deducted, as would be simple interest on the amount advanced, for the time specified in the note.

**Discoveries of America to 1542, Spanish and Portuguese:** John Fiske writes: "Properly regarded, the discovery of America was not a single event, but a very gradual process. It was not like a case of special creation, for it was a case of evolution, and the voyage of 1492 was simply the most decisive and epoch-marking incident in that evolution."

Half of a century was occupied in the principal Spanish and Portuguese discoveries which, being followed by colonization, gave to those nations their vast possessions in the western hemisphere. In 1492 Columbus landed on Watling Island, which the natives called Guanahani, and which he named San Salvador, 12 October (see BAHAMAS); discovered Cuba 28 October; Hispaniola, now called Haiti or Santo Domingo, 6 December; thought Haiti must be Japan, and Cuba the Asiatic mainland; deserted by Martin Pinzon with the *Pinta*, and his flagship the *Santa Maria* having been wrecked, he returned to Spain in the *Niña*, arriving at Palos 15 March 1493. In 1493, seven weeks after the return of Columbus, Pope Alexander VI. assigned undiscovered lands, etc., west of a certain line to Spain, and east of the same line to Portugal (see DEMARCATION, LINE OF); on 25 September Columbus sailed from Cadiz, his second voyage bringing him in sight of the island of Dominica, 3 November; Guadeloupe and Marie Galante were discovered 4 November; Antigua 10 November; Porto Rico later in November, and the town of Isabela was founded on the northern shore of Hispaniola in December. The ruins of Isabela, the first town established by Europeans in America, are to be seen about 25 miles west of

Puerto Plata. In 1494 Columbus discovered Jamaica, 3 May; the Isle of Pines 13 June. In 1497 Vicente Yañez Pinzon, Solis, Amerigo Vespucci, and others sailed from Cadiz, 10 May; probably their first landfall was the coast of Honduras, whence they followed the coast of Mexico and the United States, rounding Florida, and proceeding up the Atlantic coast to "the finest harbor in the world," conjectured to be the Chesapeake Bay; returning to Spain by way of the Bermudas, and reaching home 15 Oct. 1498. In 1498 the third expedition of Columbus started on 30 May from the Spanish port of San Lucas de Barrameda; discovered Trinidad 31 July; Columbus caught a glimpse of the land at the delta of the Orinoco, and called it *Isla Santa*, or Holy Island, 1 August, but after passing the mouth of the Orinoco reasoned that so vast a stream of running water could be produced only upon a continent; went westward to Cubagua. In 1499 Vespucci, with Ojeda and La Cosa, followed the northern coast of South America for a long distance, seeing a part of the coast of Brazil, the Guianas, and Venezuela, and proceeding west of Cubagua as far as the Gulf of Maracaibo and Cape de la Vela. In 1500 Vicente Yañez Pinzon (who had sailed for Spain in December 1499) struck the Brazilian coast near the site of Pernambuco, 20 January, and discovered the Amazon 26 January; Diego de Lepe, between January and June, followed the Brazilian coast to latitude 10° S. approximately. Cabral landed on the Brazilian coast, which he explored from about 12° to 16° 30' S., taking possession in the name of the king of Portugal (see BRAZIL); Bastidas, La Cosa, Balboa, and others (see CENTRAL AMERICA), sailing in October, explored westward from Cape de la Vela to the Gulf of Urabá, and beyond that to Puerto Bello on the Isthmus, the voyage ending September 1502; Gaspar and Miguel Cortereal made voyages to Labrador in the interests of Portugal (1500-1-2), but the coasts visited were mainly within the region previously explored by the Cabots. In 1501 Vespucci sailed for the Brazilian coast, 14 May, his voyage ending 7 Sept. 1502; he explored the Atlantic coast of South America from 5° S. to 34° S., and sailed thence to South Georgia Island, 54° S. In 1502 Columbus set out on his fourth voyage, 11 May; discovered Martinique 13 June; during the latter part of that year and the earlier part of 1503 he carefully studied the coast between the gulfs of Honduras and Darien, especially that of the narrowest part of the Isthmus (see CENTRAL AMERICA). In 1503 and 1504 Coelho and Vespucci sailed along the coast of Brazil, the former to about 40° S., the latter to about 23° S.; Jaques explored the Brazilian and Patagonian coasts to about 52° S. In 1505 and 1507 Vespucci, La Cosa, and others explored the Atrato River and the Darien region. In 1508 Cuba was circumnavigated by Ocampo, and thus first known to be an island; during a voyage extending from 29 June 1508 to October 1509, Solis and Pinzon explored the Brazilian coast to about 40° S. In 1512 and the following years explorations of the interior of Colombia, etc. (see DABATBA), were undertaken in the hope of finding an Eldorado. In 1513 Balboa (q.v.) discovered the Pacific; Ponce de Leon in March discovered some of the Bahamas, and on Easter Sunday, 8 April, landed on the coast of



Florida. In 1516 Solis, searching for a strait at La Plata River, was killed by the natives. In 1517 Córdova explored the coasts of Yucatan. In 1518 Grijalva explored the Mexican coast, gulf, etc. In 1519 Cortés discovered and began conquest of the Mexican uplands of the interior. In 1520 Magellan discovered the straits which bear his name, 21 October; entered the southern Pacific Ocean 28 November. In 1524 the first (unsuccessful) expedition sailed from Panama bound for Peru. In 1527 Narvaez led an expedition to the upper Gulf of California. In 1531–33 a part of the empire of the Incas (see Cuzco; PERU) was explored and conquered by Francisco Pizarro and others. In 1535 Grijalva discovered California; Diego de Almagro led a force into Chile, but was compelled to withdraw. In 1540 Pedro de Valdivia set out from Peru to succeed where Almagro had failed. In 1541 Francisco de Orellana descended the Amazon from Peru. In 1542 Gonzalo Pizarro returned to Quito from the exploration of the heart of the South American continent; and about the same time De Soto died in the Mississippi valley, having discovered the great river of the North American continent.

MARRION WILCOX,  
*Authority on Latin-America.*

**Discovery**, in law, the act of a litigant who is called on to reveal or make known any matter or document which will aid in enforcing a right or repelling an unjust demand.

**Discovery**, *The*, a ship noted in the history of exploration, as the vessel built by the East India Company in 1602 to determine the whereabouts of the northwest passage. She was originally commanded by Capt. George Weymouth, who sailed with a consort from Greenland, 2 May 1602. In 1610 Henry Hudson discovered the Hudson Bay in the same vessel, spending the succeeding winter in the ice. In 1611 the crew mutinied and set Hudson and some of his companions adrift, never again to be heard of. Later she was commanded by Sir Thomas Button (q.v.) who discovered Nelson's River and other points. In 1615 and 1616, the *Discovery* sailed with Baffin (q.v.) and Bylot, making important discoveries and explorations. In 1875–6 the name was borne by a steam vessel, one of the two in Nares' expedition.

**Discovery of America.** See AMERICA; NORSEMAN.

**Discus**, among the Greeks and Romans a quoit of stone or metal, from 10 to 12 inches in diameter, convex on both its sides, sometimes perforated in the middle. The players aimed at no mark, but simply tried to throw the quoit to the greatest possible distance. It was sometimes furnished with a thong of leather to assist in the throwing. The throwing of the discus was a notable feature of the revival of the Olympic Games at Athens in 1896. In these games the discus-throwing event was won by Robert Garrett of Princeton University, who far outclassed all the foreign competitors. The world's record in 1900 was 118 feet 9 inches, held by C. Henneman, an American. See DISCOBOLUS; QUOITS.

**Disease**, a term which refers to any morbid deviation from normal health—as disease of mind or body—and refers specifically to a group of morbid conditions which may affect the

same part of the body and exhibit similar symptoms, such as disease of the lungs, disease of the brain, Bright's disease, that disease of the arteries which causes a hardening of the muscular elastic coat, and which is called arteriosclerosis, disease of the mind (Jastrow). Such a definition posits the knowledge of what is normal, and this is often a very difficult position to understand. Thoma has suggested as an empirical definition of disease a deviation from the normal in its anatomical or chemical structure, or in the functions of the body, its organs and elements of organs, which exceeds the limits of individual physiological variation. This definition, the author himself admits, gives no explanation of the nature of the processes. It does no more than to give the criteria for deciding when any condition is to be called pathological. That is, it may readily be seen that any definition of disease from a general standpoint must necessarily take into consideration what normal physiological variations may be, and it is now acknowledged that no hard and fast lines can be drawn between normal and pathological processes. Barker has well said: "The activities of cells are subject to certain definite laws, which hold in diseased conditions of the body as well as in health. When the structure or function of the organism differs markedly from a normal standard for the species, the reason lies either in abnormality in the inherent activities in some or all of the cells of the body or in the abnormal nature of the environmental influences to which some or all of the cells are exposed, or in both. In any of these cases, morbid instead of normal reactions are encountered. In the first instance, environmental influences, normal for healthy individuals, would call forth morbid reactions; in the second instance, individuals previously healthy would become diseased through environmental influences which are incompatible with the maintenance of health because outside the ordinary deviations from the average; and in the third instance the two conditions would be combined. Properly speaking the science that studies diseased or abnormal conditions is called pathology, but because of the extension of the science it is divided into several departments. Thus one distinguishes general pathology from descriptive pathology. General pathology stands with reference to special pathology in the relationship that philosophy occupies with reference to the individual sciences. It is the synthesis of the forms which special pathology affords. It endeavors to find out the laws that govern disease in general, searches for the causes of disease, discovers the order of events in diseased conditions, and groups the symptoms and lesions common to whole series of special pathological processes. Commonly it is popular to speak of diseases as organic and functional; organic diseases having attached to them definite structural changes in the organs affected; functional diseases being understood as diseases in which no such structural changes are demonstrable. This is a purely artificial distinction, however, and on close analysis cannot be maintained. Diseases are classified in general for purposes of general inquiry, particularly as to the statistical studies for economic purposes such as are involved in tabulation of cases of death, by health boards, for hospital returns, and for medical departments in the army and navy. These classifications are of great importance for the gathering



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of much useful information, but they are naturally subject to much change, as new discoveries ally certain heretofore apparently unrelated diseases under common heads. Consult Hektoen, 'American Text-book of Pathology.'

**Diseases, Germ Theory of.** As a speculation, the germ theory of disease is centuries old; as demonstrable in fact, however, it is a thing of but yesterday. Aristotle in the second century believed that certain diseases were due to microscopical organisms, although he and many others who believed the same could not prove it, but it was reserved for Pasteur, Koch, and other modern students of the young science of bacteriology to demonstrate beyond doubt that certain disease processes result from the invasion of the human body, as well as those of animals and plants, by certain forms of lowly organized plant and animal life, and that the disturbance in the healthy functions of these animals and plants is an indication of the battle taking place between the living animal or plant cells and their animal or plant parasites.

In the early days of the germ theory of disease, it was thought that only plants such as molds and bacteria could give rise to disease, but it has been further demonstrated within recent years that there are a large number of lowly organized animals which might obtain an entrance into the body and there cause disease. Historically it is of interest to note that one of the first diseases definitely proven to be associated with bacteria was a certain disease of silkworms. This was studied by Pasteur, and opened the way to subsequent discoveries of modern bacteriologists, so that at the present time it is clearly proved that such affections as diphtheria, tuberculosis, typhoid fever, pneumonia, cholera, tetanus, anthrax, relapsing fever, influenza, erysipelas, rheumatism, the plague, glanders, and actinomycosis, are due to definite bacteria, while malaria, certain forms of dysentery, certain forms of abscess of the liver, and some skin diseases are known to be caused by low forms of animal life, the protozoa; and still higher in the animal kingdom it is known that certain parasitic worms give rise to definite forms of disease, some of these being known as distomiasis, ascariasis, trichinariasis, uncinariasis, filariasis. In addition to these the ordinary tapeworms may be mentioned. With reference to the bacterial agents that cause disease, in the article on bacteria (q.v.) it was pointed out that there were a great many forms of these plants and that only a few of these were known as pathogenic, or as disease-producing. This term pathogenic, however, is purely a relative one, because under certain circumstances the introduction of well-known pathogenic micro-organisms in the human body may be harmless. In the study of the pathogenic effects of any given bacterium both the micro-organism and the animal host should be taken into consideration, because any resulting disease is a product of some detail of the characters of the infecting agent on the one hand and of the subject of the infection on the other. There may be many modifying circumstances, involving each of these factors. Thus as regards the character of the particular species of bacterium that may enter the body, its effect will depend chiefly upon its inherent virulence, the number that may be introduced into the body at one

time, and the path through which the infection takes place. Thus the virulence (meaning largely the power of multiplying) of many micro-organisms in the body varies greatly under different conditions. With reference to the number: The healthy tissues can resist the certain number of pathogenic micro-organisms of given virulence, but if a larger number are introduced it may be that the animal will succumb. This is a fact demonstrated to be true for tuberculosis in high degree. The path of infection is of much importance, for if virulent micro-organisms are thrown directly into the blood-stream, and can thus traverse the entire body looking for a favorable nidus or growth, the chances are much against the organism. With reference to the subject of infection: The species of the animal, his race peculiarities, and his age are all important items. Thus it is known that tuberculosis among the Indians is extremely fatal; whooping-cough, when first introduced into New Zealand, was almost universally fatal; children are susceptible to infectious diseases which the adult escapes; local diminished vitality plays a very important role in the production of disease in many individuals. See IMMUNITY.

As to the modes of bacterial action, two main factors are known to be involved; one concerns the ability of the bacteria to multiply in the animal body after they have once entered, and the other, the production of poisons by them that may act upon the tissues. The former process is known as the infection, the latter as the intoxication. Thus in the discussion of the germ theory of disease, it is understood here that the disease process as seen in the individual is nothing more or less than an evidence of the struggle that takes place between the protective agencies of the body on the one hand and similar self-assertive processes taking place in the bacterial body, for it can hardly be denied that rapid multiplication and the production of poisons are the means employed by bacteria for self-protection. This production of poisons is one of the most interesting features of the study of bacterial diseases, and it is probably true that these poisons, or toxins as they are termed, result both from the breaking down of the nutrient materials on which the bacteria feed, and as a result of their intravital activities. It is probably true that the action of bacteria as disease-producers depends largely upon the chemical products formed directly or indirectly by them, and that this action is shown by certain tissue changes that are produced in the body, local or systemic, and by symptoms of intoxication of varying character. The tissue changes that may be produced by bacteria are so various as to include almost every type of known pathological change. In general, however, they are those of a degenerative or necrotic nature, indicating direct damage, or they are those of a reactive defensive nature on the part of the body of the infected animal, the former indicating the degree of vulnerability, the latter the protective power that the tissues possess. Many of the symptoms occurring in bacterial affections result from the changes just outlined, and it is of importance to note as a special proof of the truth of the position that bacteria may cause disease that nearly all, if not quite all, of the changes found in the organs

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of a diseased body, and also the symptoms observed in infective disease, can be experimentally reproduced by the injection of bacterial poisons. Of the precise chemical nature of these poisons very little is known, therefore the general term toxins has been applied to them. It is known, however, that both the living and the dead bacteria contain these intracellular toxins, and therefore dead bacteria under certain circumstances can bring about destructive changes in the human body. It would seem from the recent work of Brieger, Martin, Fraenkel, and others that these bacterial toxins belong to the general group of albumoses, and that their action is analogous in many ways to a number of enzymes. Many of them are allied to well-known animal and vegetable poisons, such as ricin, abrin, and a number of the snake-poisons, particularly those of the rattlesnake and the heloderms. For theories of toxic action, and details regarding protective agencies of the human or other animal body in its struggle with disease-producing micro-organisms, see IMMUNITY. See also ANTITOXINS; DISEASE.

**Diseases of Plants.** Diseases in plants have existed as long as plants themselves—ages before the advent of man. Civilization and agriculture have usually developed together in all parts of the earth and it is not strange that anything that troubled or destroyed an important food plant should be observed and the cause sought. In the earliest historic records as well as in early Greek and Roman times some of the more destructive diseases of plants, like rust and mildew or blight of cereals were widely known and discussed. A special deity was recognized who ruled these phenomena and to whom sacrifices were offered.

Injury due to animals, especially insects, and to extremes of weather and unfavorable soil conditions were early often associated with their appropriate causes. It was not, however, until the latter part of the 18th and the beginning of the 19th century that the solid foundations of plant pathology were laid by the development of anatomy and physiology. The early works of Unger, 'Die Exantheme der Pflanzen,' etc., (1833); Weigmann, 'Die Krankheiten und Krankhaften Misbildungen der Gewächse' (1839); and of Meyen, 'Pflanzenpathologie' (1841), mark an important step forward in the embryo science of plant pathology. During this period microscopical, chemical, and physiological work with plants was active. The writers of this period rather overworked unfavorable nutrition as the cause of disease. Maladies that could not be traced to visible external causes were usually held to be due to unsuitable nourishment or the lack of something in the soil. It was not believed that the fungi so often found associated with diseases had any causal relation to them. They were held to be abnormal developments of the diseased cells themselves and not independent organisms. It remained for De Bary to determine the true nature and habits of fungi and bacteria and to demonstrate their causal relation to disease in many cases. His careful work gave a great stimulus to investigation in plant and animal pathology and opened what has proved to be the most important field of the science. His two most important works are 'Untersuchungen über die Brandpilze,' etc. (1853), and 'Morphol-

ogie und Physiologie der Pilze,' etc. (1866). Since De Bary the rapid development of the subject is well represented by the works of Hartig (1874-89), Frank (1880-96), Sorauner (1886-8), Marshall Ward (1889-1901). The last work, 'Diseases in Plants,' is one of the most excellent and readable expositions of the subject that has appeared.

**Health and Disease Compared.**—That there is no defined line between health and disease is generally recognized by pathologists and physiologists. A plant continually varies in response to changes in its environment. There is, however, for each individual and for a given species as a whole a certain accustomed range or power of adaptation to each factor of its environment and to the various combinations of these factors. The process of natural selection operates to perfect this adaptive attuning of the individual and the species as a whole to the conditions under which they live. If these conditions are subject to great extremes of moisture and dryness or heat and cold, the natural or indigenous vegetation will be found, as a rule, equal to the emergency, while an introduced species, if developed under an environment not subject to such extremes, might be seriously injured or destroyed, and if the change is very unusual even the indigenous species may suffer. A moist, warm, cloudy spring may be followed by dry hot weather and the tender watery growth be so much dried out and checked that it may be deformed and abnormal in shape, structure, and size. This variation may be slight or it may be great. If it is slight it may have no appreciable effect on the vigor and growth of the plant. The leaves become a little firmer and smaller and more resistant to the hot, dry conditions, while the maturer leaves that can not adapt themselves to the change turn yellow and fall, cut off by the parent plant. The plant is better for the change and can live under the modified conditions with greater ease and safety.

If the variation is greater the growth of the plant may be decidedly checked, the leaves being small and many more of them shed. In still more extreme cases the tender leaves may be dried up and killed either wholly or in part. According to Hartig, "It is only when the sickly condition leads to the death of some part of the plant that we may speak of actual disease." Where a few leaves, unable to adapt themselves to a changed condition, turn yellow and fall, the leaves themselves may be diseased, but the plant as a whole is benefited by their loss by being relieved of sources of uncontrolled drain of its water supply. As the loss of leaves becomes greater, however, we pass from the extremely localized disease to a point where the whole or a considerable part of the plant is weakened, either by the direct loss of food that should be furnished by the leaves to the rest of the plant structure, or by the use of reserve food in the reproduction of lost parts. It is evident in such cases that the border line between health and disease is hard to define. The case is not much easier if, instead of variations produced by moisture and temperature, we consider those caused by insects or fungi. A few leaves eaten from a tree by some insect or destroyed by a fungus might have no injurious effect on the tree as a whole, and might even be an advantage, but as the number of injured leaves increases the tree is weakened and

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its life threatened. Slight doses of certain poisons stimulate the cells to more vigorous growth, acting as a tonic, while a little larger dose poisons and destroys the cell. Leaving all questions of consistency of definition, we may practically define as diseased all those conditions of a plant which directly or indirectly endanger its life or prevent normal development under given conditions of environment. Or, as Marshall Ward puts it, "We may define disease as dangerous disturbances in the regularity, or interference with the completeness or range of the molecular activities constituting normal life—that is, health—and it is evident that every degree of transition may be realized between the two extremes."

*Classification of Diseases.*—The method of classification adopted is more a matter of convenience than importance. Most writers in plant pathology base their classifications on the causes of disease. Frank, for example, adopts the following outline: (1) Effects of insufficient room or space; (2) Effects of wounds; (3) Diseases due to atmospheric influences; (4) Diseases due to soil influences; (5) Diseases due to the action of injurious substances; (6) Diseases due to injurious plants; (7) Diseases due to injurious animals; (8) Diseases without any noticeable causes.

Hartig discusses diseases of trees according to the following scheme: (1) Diseases induced by Phanerogams; (2) Diseases induced by Cryptogams; (3) Wounds; (4) Diseases due to unfavorable conditions of soil; (5) Diseases due to unfavorable atmospheric conditions. While a classification based on cause is more scientific and more convenient for the pathologist, classifications based on the plant, the part of the plant attacked and the symptoms, are the most intelligible and convenient for those who devote themselves to the practical cultivation of plants. According to such an arrangement we should have diseases of roses, carnations, violets, lilies, wheat, corn, oats, rye, apple trees, peaches, plums, maple, alder, birch, etc. Under each head we could subdivide into diseases of roots, stems, leaves, flowers, and fruits, and again according to symptoms—decay or loss of parts, swellings, galls, shrinking, cankers, spots, discolorations, etc., finally coming down to the causes. It cannot be too strongly urged that pathologists writing for practical men adopt this latter type of classification at least as a key for the identification of specific diseases, as Hartig has done in his excellent work on the 'Diseases of Trees.' In practice we have in plant pathology, the same as in animal pathology, first carefully to examine, determine, and interpret the symptoms (diagnosis), then to find and study the causes (aetiology). We are then in a position to determine curative measures (therapeutics) or preventive measures (prophylaxis).

The general survey of the subject of plant pathology as planned in this article is based on the following classification:

I. Constitutional conditions—predisposition and immunity.

II. Diseases without apparent cause.

III. Diseases caused by the non-living environment.

- (a) Conditions of soil or substratum.
- (b) Atmospheric conditions.
- (c) Temperature.

(d) Light.

(e) Electricity.

(f) Shock or jars—mechanical.

IV. Diseases caused by the living environment.

(a) Antagonistic association, crowding, isolation, etc.

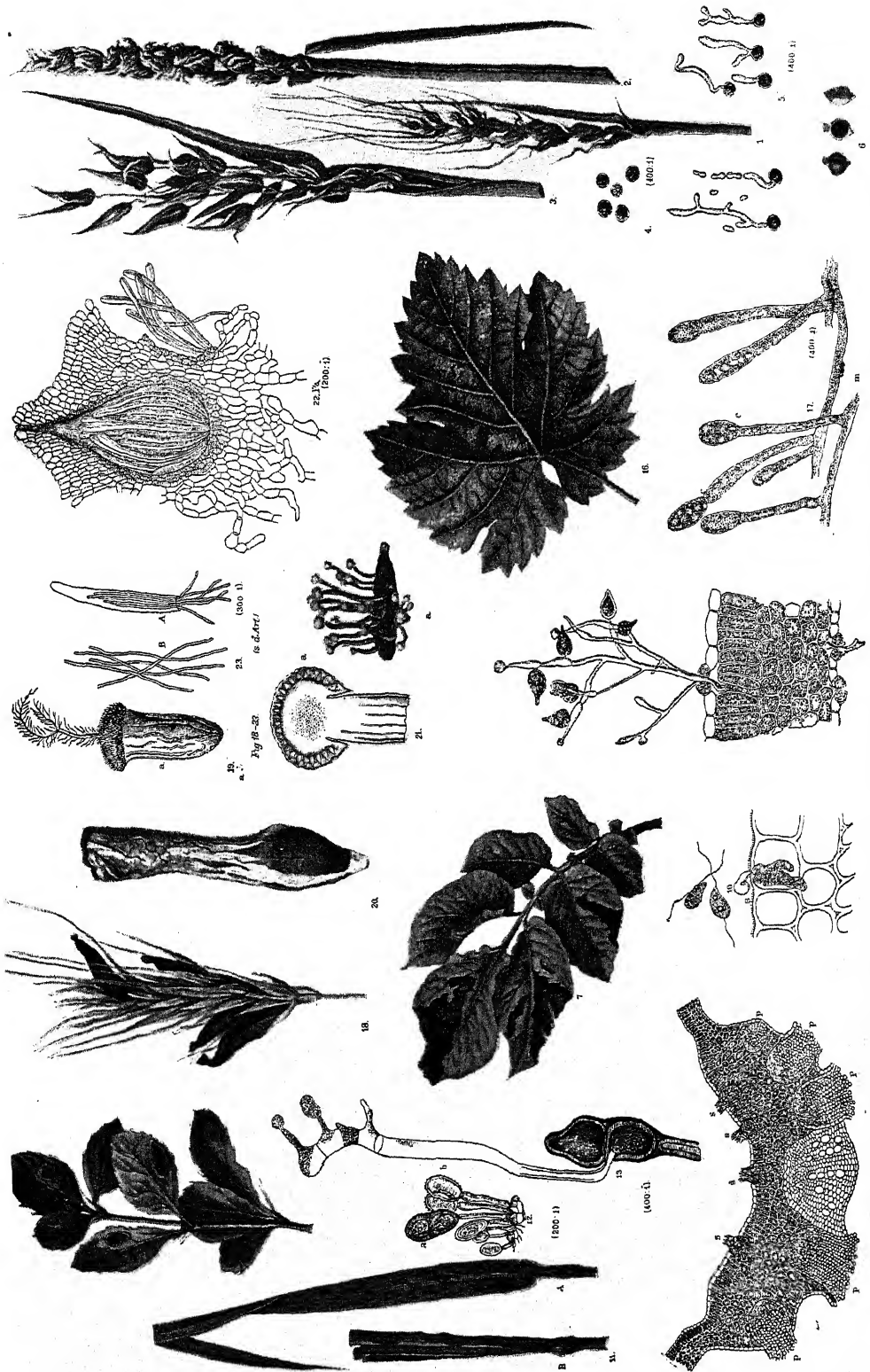
(b) Vegetable parasites.

(c) Animal parasites.

*Constitutional Conditions—Predisposition and Immunity.*—A plant may be likened to a very delicately constructed and complex machine automatically adjustable under certain conditions and capable of running and doing work if properly supplied with energy. The accurate and perfect working of the machine depends first upon the perfection of its construction and adjustment, down to the minutest detail. If it comes from the manufacturer with a wheel or screw missing, or the parts incorrectly adjusted or made, it must do its work, if at all, with more or less imperfection, and we may consider that the mechanism has a constitutional difficulty or imperfection. Perhaps a new machine is assembled from parts of old ones so differing from each other that it becomes impossible to produce a perfectly co-ordinated mechanism. Some of the variations that occur in the constitution and organization of plants during the processes of reproduction and development are of the nature of such imperfect construction or adjustment. When these imperfections endanger the life of the plant we have a constitutional disease, or at least a predisposition to disease.

Predisposition to disease may be normal or abnormal. Normal predisposition is where some perfectly normal condition of growth makes the plant liable to injury. Young cereal plants, for example, are liable to infection by smuts, while older plants are quite resistant. When the formation of young, tender growth coincides with the spore dissemination of some fungus or the prevalence of some insect best able to attack growth in such condition, the plant is at this stage normally predisposed to such attack. In the same way there may be normal predisposition to injury by cold, light, heat, etc., but in no case of this kind could the predisposition be considered in any sense disease. Abnormal predisposition is where some abnormal change takes place in the plant from any cause which lowers its vitality or resistance, and which is in itself a pathological condition. Wounds and mechanical injuries may permit the entrance into the plant of insect or fungous parasites, as is the case with many of the wood rot fungi. Injuries from cold or heat may reduce the normal resistance to parasites. Plants which have been severely chilled during rapid growth, though not to the point of killing or even freezing, are often unable to resume normal growth even under the most favorable conditions. They appear to be partially paralyzed and are in this condition extremely subject to insect and fungous attack. So may predisposition develop as the result of starvation, overfeeding, or unbalanced nutrition even before the initiative pathological changes have become chronic.

Genera, species, and individuals vary among themselves in liability to disease or resistance to it as they do in other ways. Races resistant or immune to certain unfavorable conditions or



1-6. Brand-fungi (Ustilagineae) of Oats and Wheat, with Spores. 7-10. Potato Rot. 11-15. Rusts, showing effects on leaves. 16. Leaf affected by Ergot-fungus, showing development and effects. 17. Oidium-growth. 18-23. Hymenomycetous Fungi (Oidium).



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parasitic enemies are common in nature, and may develop as the result of natural selection, or more quickly and certainly as the result of artificial selection of a natural tendency. If a natural tendency to resistance is not present in a given species, race, or variety, it may be introduced into new generations through the processes of breeding and selection combined. The production of plants for special purposes resistant or immune to certain diseases, is proving of immense value to agriculture. On the other hand, both in natural and artificial selection and breeding, non-resistant or sensitive individuals, varieties, and races may develop or be developed unusually subject to disease.

Seedless or non-fertile individuals may result from too close fertilization, or where the parents are too distantly related; or if seeds are produced in such cases, the individuals grown from the seeds often lack in vigor or reach an incomplete or imperfect development the same as in animals.

Many species of plants, like the violet, strawberry, lilies, and bulbous and tuberous rooted plants in general, are naturally propagated by vegetative offshoots, runners, buds, bulbs, etc., and by seeds. The seed generations under normal conditions are usually the most vigorous and variable. Take, for example, plants from the seeds of *Lilium harrisii* (Bermuda lily), derived from crossing individuals of the same variety, as compared with plants from bulblets of the same individuals propagated for many years by bulb generations, and note the differences. The plants direct from the seed and from the bulbs produced by the seedling generation are relatively much more vigorous than the plants from bulbs distantly removed from a seed generation. The latter are much more sensitive than the former to the attacks of aphides and red mites on the leaves and the bulb mites on the bulbs and roots. The latter are also more sensitive than the former to fungous parasites, and to unfavorable conditions of the non-living environment. The same is true of the cultivated violets, especially the varieties that are propagated from runners and seldom produce seed on account of the doubling of the flowers. Long continued asexual propagation appears in these cases to gradually reduce the power of individual adjustment or adaptation to changes in environment, resulting in decreased vigor and resistance to unfavorable conditions. On the other hand, there are many varieties of plants thus propagated that do not appear to suffer in this way. That it is the cause of predisposition to disease in some cases, and even constitutional derangement, must not be overlooked in the study of the ætiology of a disease.

*Diseases without Apparent Cause.*—Under this head a number of obscure but well-defined diseases are grouped, the ætiology of which is still unknown. Among these are the California vine disease, peach yellows, and peach rosette, little peach, some forms of gummosis of the stone fruits, die back of the orange, and a score of other diseases, apparently contagious, though the cause has not yet been found.

*Variegation.*—Formerly variegations were included in this class. These are characterized by the development of white, yellow, or colored spots, blotches, segments, stripes, or bands in the otherwise apparently normal green leaves. The transition from the diseased to healthy

cells is usually sharp and well defined from the youngest to the oldest stages of the leaves or other tissues involved. Any particular cell is subject to the disease only while in a state of active division. It therefore never spreads to a cell that has stopped dividing. The diseased cells are usually smaller than healthy cells, and are of much slower growth. The nucleus and protoplasm are more vacuolate, but the most apparent change is in the development of the chloroplast and the chlorophyll. The chloroplasts may be reduced in number and size, and the chlorophyll may be reduced or entirely absent. The change in the diseased cells themselves is often progressive, starting with a reduction of chlorophyll, gradually fading to yellow, then to white as the cell matures. In many cases the disease is transmitted through the seed and is thus hereditary. In others it is propagated only by division of the original plant by buds, cuttings, etc. When a variegated bud or branch is grafted into young, rapidly-growing tissues of a normal or healthy plant of the same variety, branches formed above and below the graft often become variegated, demonstrating that the disease is thus transmissible or infectious. When it once appears in a plant it is very persistent, especially when it has gone to the point of involving the seed generation. Sometimes, however, a plant which has been producing variegated growth suddenly returns to the normal green. While such changes are usually classed as spontaneous variations, they differ in many respects from normal variation. Recent investigations by the writer and others have demonstrated that variegations, including the so-called mosaic diseases, develop as the result of certain disturbances of nutrition of the young dividing bud cells. Certain substances (oxidizing enzymes) present in the cells in an inactive form or in small amount become active or increased in quantity and prevent the development of chlorophyll or cause it to fade. These enzymes injected into the growing points of healthy buds, as demonstrated in the case of tobacco, cause the disease in all dividing cells infected. We have here, then, a toxic enzyme produced by the plant itself under certain disturbing conditions capable of producing the same disease whenever the enzyme comes in contact with dividing cells. The abnormal increase in this enzyme may be brought about in several ways—as by a chill during rapid cell division, severe cutting back, root injury, or defoliation, followed by the production of new growth in the absence of sufficient reserve food, especially proteid. Consult Bulletin 18, Bureau of Plant Industry, United States Department of Agriculture.

All forms of variegation weaken the tissues involved and make them more subject to insect and fungous attack and more easily injured by cold or high temperature. Besides this the changes are in themselves strictly pathological, and threaten or cause the premature death at least of the parts affected.

*Albinism.*—When the loss of the green coloring matter is complete and apparently spontaneous, not curable by addition of some lacking nutrient, it may be classed with variegations. Other forms of albinism, yellowing or chlorosis are brought about by lack of iron, excess of lime, carbonic acid, lack of light, etc., and will be further discussed when these factors are



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considered in relation to disease. The cure and prevention of diseases of this class must be based on securing and maintaining a correctly balanced nutrition for the young cells—protecting them from shocks, especially those due to temperature variations. Peach yellows and rosette, California vine disease, die back of the orange, and diseases of this type can be controlled only by rooting out the diseased individuals upon the appearance of the first symptoms. At the present time we know no cure for these particular diseases. In many respects they behave like variegation or mosaic diseases.

### DISEASES CAUSED BY THE NON-LIVING ENVIRONMENT.

From what has been said in previous paragraphs, it is evident that unfavorable physical and chemical conditions of the soil, excessive dryness or moisture of the soil or atmosphere, unfavorable conditions of temperature, light, etc., may cause derangements resulting in temporary or chronic disease. Plants which have become adapted by natural or artificial selection to a certain range and sequence of soil, moisture, temperature, and light conditions usually suffer some sort of derangement if exposed to a set of conditions materially different in any particular factor, group of factors, or in the relation of these to each other. It is absolutely necessary, therefore, in studying the ætiology of diseases to know the natural or constitutional requirements of the plants and their powers of adaptation. This knowledge can be obtained only by long and intimate acquaintance with the kind of plants in question under varying conditions.

*Soil.*—In natural conditions it is a matter of general observation that certain varieties of plants thrive best on particular kinds of soil, the same as in particular conditions of light, temperature, and moisture. The storage and movement of water in soils and its availability to plants, the solution of soil foods, nitrification, temperature, and aëration depend largely upon the structure or physical composition of the soils. Water, food, air, and temperature are among the fundamental requirements of vegetation. It is the varying amounts and relations of these factors maintained by a given soil that largely determine whether or not it is *naturally* suited in a given region to a particular class of plants. Where all these conditions are under easy control the kind of soil is a matter of less importance. The work of furnishing and maintaining proper conditions is done by the gardener instead of by the soil in the latter case. It is not profitable, however, to employ soils that require close and constant attention, even where conditions are largely under control. It is the aim of economical production to select a soil for a given crop that, with a minimum of labor expended on the part of the cultivator, produces the desired results. It is evident from these considerations that the conditions of the soil must be considered in connection with all of the other factors of environment, as no one of them ever acts independently and alone in the production of disease. The plant, too, has to be considered. It may be adapted to withstand the variations that take place in a sandy soil in a locality characterized by particular meteorological conditions,

while it could not thrive in a clay soil in the same locality. On the other hand, with changed meteorological conditions the same plant might do best in the clay soil.

*Root Suffocation.*—This is one of the most usual diseased conditions caused by physical conditions of the soil preventing the ready access of atmospheric oxygen or the ventilation of the soil. A very fine sand closely packed, or a clay soil with a crust excludes the air, unless the sand is stirred or the crust broken. Carbon-dioxide accumulates and the oxygen is reduced. The root hairs and feeding roots die for lack of sufficient oxygen for respiration. Growth is checked by starvation due to reduced root action. The tissues become hard and woody. The plant may then die in dry, hot weather by desiccation, or it may simply starve to death. Plants injured in this way, even slightly, often become the prey of insects and fungi, especially of those that attack the roots. This form of suffocation is also often found where the roots of plants have to grow under close pavements or hard packed ground or heavy sod. Another form of root suffocation results from poor drainage or excess of moisture in a soil, thus excluding the oxygen and preventing soil ventilation. The feeding roots die and ferment, not only cutting off the proper absorption of soil food elements but resulting in poisoning the plant by products of fermentation. The leaves rapidly turn yellow and drop, and unless the soil is dried out and aërated the plant soon dies. This latter form of root suffocation is very common among plants grown in pots or tubs. When the natural drainage is stopped up or the plant is over-watered, the soil becomes sour.

The best thing to do in such cases is to repot the plant into fresh soil containing a little lime or wood ashes, first washing off the old soil and trimming off the diseased roots. Good drainage must be furnished and over-watering avoided. It must be clearly understood that the roots of all plants require an abundant supply of oxygen, and that they will suffocate and die if they do not get it.

*Poisonous materials* in the soil are also often the cause of serious root injury. Illuminating gas leaking from gas mains or pipes and diffusing through the soil in the minutest quantity kills and poisons the roots of all kinds of vegetation. The only thing to do in such cases is to stop the leak and air the soil.

The decomposition of organic matter, especially manures rich in nitrogen, in soils not well supplied with oxygen, results in the formation of products injurious to the roots of plants. Injurious acids are often set free from their combinations in the soil by the action of plant roots, bacteria, and fungi, and by chemical changes brought about by the use of certain fertilizers, like the acid of superphosphates. In all those cases a liberal addition of lime to the soil acts as a cure to the injured plant and corrects the acid condition.

*Alkali Soils.*—In some cases, on the other hand, there is too much lime or other alkaline material such as carbonate of soda, etc., in the soil. The root hairs and feeding roots are killed by a sudden rise of a soluble alkali, or they may die a slow death if there is too much lime. It is a curious fact that a liberal addition of gypsum tends greatly to reduce the injury in both these cases and to raise the limit of endurance

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of most crops to alkali. Where alkalies can not be washed out of soils through proper drainage, much can be done by breeding and selecting varieties of plants better adapted to such condition. Great progress has already been made in this direction with alfalfa, sugar beets, cereals, date palms, etc.

**Soil Nutrients.**—Every green plant requires for its healthy development, besides water, oxygen, and the  $\text{CO}_2$  of the air, a certain proportion of nitrogen in the form of nitrates or ammonia, a salt of potassium and of phosphoric acid, available calcium and magnesium in about equal proportion, sulphur, and a trace of iron and chlorine. If these are not available to the plant in the right form or ratio, or if any of them is too greatly in excess or lacking, a diseased condition of the plants in such soils quickly develops.

**Nitrogen.**—Lack of nitrogen in available form causes a proportionately diminished vegetative growth, light green or yellowish leaves, even where there is abundant moisture and other nutrient materials. An excess of nitrogenous fertilizer, on the other hand, causes various pathological derangements. Abnormal vegetative growth at the expense of flowers and fruit thus inducing temporary sterility is one of the commonest results of a food containing too much nitrogen in comparison with potassium and phosphoric acid. The tissues in such cases are likely to be soft and watery, easily injured by unfavorable temperature or moisture conditions as well as by insect and fungous parasites.

**Tissue degeneration** is in many cases the result of over-feeding with nitrogenous fertilizer. This appears to be one of the commonest causes of "die back" or gummy degeneration of the orange. Peaches and plums also suffer from a similar malady from the same cause. Large gum pockets develop in the wood as a result of the degeneration of the cells. The movement of water and food materials in the plant is greatly interfered with. The wood does not mature properly and as a result winter kills, or is destroyed by insect and fungous parasites.

**Phosphoric acid** is an important constituent of every living cell, entering largely into the composition of the nucleus. Its reduction below the cell requirements is followed by a cessation of cell division and growth and in green cells by disorganization of the chlorophyll which first becomes reddish, then yellow. These latter changes take place first in the maturer leaves, then in the younger parts. An application of phosphates or superphosphates usually promptly corrects these pathological conditions.

**Potassium** also is required in considerable quantity by all plants. One of the first signs in a plant of a lack of available potassium is a decided cessation of growth without other apparent cause of trouble. During the early stages of potash starvation the plants often retain their normal green color. In later stages very little starch or sugar is made and almost no protein or nitrogenous matter. Unless the missing element is supplied the plants finally become yellow and slowly die. Potassium hastens and perfects the maturing of plants, especially the ripening of the wood of perennial plants, making them less liable to winter injury.

**Calcium.**—Lack of this element in plant nutrition is first indicated by a more or less marked yellowing of the young leaves due to a reduction in number and size of the chloroplasts though the chlorophyll itself may be normal. The starch made by the chloroplasts is converted with difficulty into sugar. This retardation is probably due to the fact that in calcium starvation the production of the starch transforming enzyme (diastase) is greatly reduced.

**Magnesium.**—While this element does not appear to be of such fundamental importance to the vegetable cell it is nevertheless absolutely required, especially during the periods of flowering and fruiting. A very small amount may often suffice to meet the requirements of growth up to the flowering period, but at this time a decided lack of magnesium results in the failure to set fruit or its failure to mature. With a more decided lack normal vegetation soon ceases, proleptic shoots develop with shortened stems, small, distorted, yellowish leaves crowded together in rosettes somewhat resembling potash starvation except in color.

It appears to be necessary that magnesium and calcium always be associated in plant cells except in some of the lower classes of plants. The ratio of one part of

magnesium to three of calcium is the most favorable in many cases though this is quite variable for different species. In a large number of cases an excess of magnesium over calcium results in greatly retarded growth and an early death of the cells.

Both magnesium and calcium oxides (lime) play a secondary part in the soil by combining with the acids set free by root action, fermentations, and other biological and chemical processes. If these were not at once combined the root hairs and feeding roots would be injured or killed and the plant would suffer from general starvation if not actual poisoning.

**Sulphur.**—This element usually absorbed by plants in the form of sulphates is one of the absolute requirements of all organisms. It enters into the structure of protoplasm and the more highly organized nitrogenous foods, proteins, required as the direct food of growing cells. Its abnormal reduction results in the cessation of proteid manufacture and consequently causes proteid starvation. Growth ceases and death follows unless the element in some available form is supplied.

Other elements and compounds are often important to the plant though not required. Silica for example is found very commonly deposited in the cell walls of plants, especially in the epidermal cells of cereals and grasses. Its presence stiffens the stems and leaves and in a measure protects them from biting and sucking insects and other small animals. Aside from decreased resistance to such attack a plant grows as well without silica as with it.

**Chlorine.**—This element in very small quantity appears to be necessary to the vigorous growth of plants, especially during the formation of flowers and fruit. In excess it is usually injurious except to plants adapted to soils rich in chlorides, such as sugar beets, asparagus, celery, etc. It is an interesting fact that sugar beets and celery are rendered much more resistant to spot diseases caused by *Cercospora* when well supplied with sodium chloride, than without it. Why this is so has not been determined.

**Iron.**—A small amount of this element is necessary to the formation of chlorophyll. An insufficient amount of iron is indicated very quickly by the formation of chlorotic or white leaves which become green on the addition to the soil of a soluble iron salt, such as iron sulphate. Often the failure of a plant to obtain iron is due to the death of the root hairs and feeding roots from various causes, alkali or acid, excessive moisture or dryness, insect or fungous attack, etc. In such cases, however, there are indications of general starvation as well as of lack of iron, and the diseased condition can be cured only by removing the cause of the death of the roots.

**Atmospheric Conditions.**—The close co-ordination between the conditions affecting the plant in the soil and atmosphere is at once apparent. In most of our ordinary plants water, with various materials in solution, is absorbed by the roots from the soil and passes up through the stem to the leaves and other parts above ground. From these there is a continual loss of moisture, regulated in part by the plant, but depending largely upon whether or not conditions of the atmosphere, light, etc., favor evaporation, or transpiration as it is more correctly termed where living plants are under consideration.

**Moisture Variation.**—Plants growing in soil and air uniformly moist have smaller root systems and a larger total leaf surface than they would have if grown under constantly varying conditions of soil and atmospheric moisture. A plant reared in a moist greenhouse will gradually shed its older leaves if the air is allowed to become too dry or the plant is removed to an ordinary dwelling room. The new leaves that develop under such circumstances are adapted to the drier air and are better able to retain the water furnished by the roots. If, however, the change from moist to dry is too sudden, the defoliation will be excessive and the new growth may develop very slowly and be poorly nourished. In the case of house plants there is almost a universal tendency to over-water the plant at such times. This brings on suffocation

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and death of the root hairs and feeding roots, and ends in death of the plant. Instead of watering under such conditions the soil should be allowed to become comparatively dry until renewed growth of leaves creates a demand for water from the roots.

Plants which have been growing for a considerable period with a comparatively small water supply develop a large number of root hairs, and firmer and smaller leaves adapted to reduce transpiration to its lowest terms. If a cloudy, wet period suddenly follows, or the plants are over-watered, they become gorged with water. The more plastic tissues start into growth, with the result that the leaves often become distorted, wrinkled, curled, or twisted. If there is a continued excess of moisture many of the root hairs and finer roots may die, and symptoms of root suffocation develop, the leaves become spotted with yellow and finally drop off.

*Edema* is a pathological condition characterized by the formation of water blisters or warts on the stems or along the vascular bundles of leaves over-gorged with water. This diseased condition often develops in plants growing in moist situations, especially under conditions where the soil is likely to be warmer than the air, thus favoring absorption of water by the roots but not favoring transpiration through the leaves. The disease often develops, also, in extended periods of moist, warm, cloudy weather.

*Burning or Scalding.*—The growth that plants make under cloudy, moist conditions is often watery and soft, an easy prey for parasitic fungi, and likely to dry out, wilt, and die easily if suddenly exposed to clear, hot weather. Such "burning" or "scalding" of the edges and tips of leaves is very common in the spring, when moist, cloudy periods are suddenly followed by clear, hot days.

*Wind* often causes injury by whipping and tearing the leaves or breaking limbs. In the latter case injuries are produced which predispose the plant (especially trees and shrubs) to attack by insects or fungi. Whenever possible all such injured parts should be cut out to uninjured tissue, and protected by antiseptic washes or grafting wax. Dry, hot winds coming early in the summer often cause the death of tender foliage by desiccation.

*Injurious Gases.*—Slight traces of illuminating gas escaping in rooms or greenhouses, or the slightest trace of sulphurous fumes from burning coal from furnaces or stoves, is extremely injurious to vegetation. The presence of these gases in the atmosphere causes the gradual yellowing, browning, and finally the death of leaves, especially the tips and edges. Although the soil, temperature, and light conditions may be the most favorable, the plants gradually die where they are more or less constantly exposed to a trace of these gases. In the neighborhood of factories or large cities vegetation is often injured, as described, by these and other poisonous gases. In some cases the amount of poisonous gas thrown into the air with the smoke from certain factories is so great that vegetation of all kinds is unable to thrive in the neighborhood. The injury extends often several miles from the factory in the direction of the prevailing wind.

*Temperature.*—Many predispositions to dis-

ease, as well as specific pathological conditions, are produced in plants as the result of unfavorable temperature conditions. As a rule, when growth is taking place and the cells contain much water, vegetation is most sensitive to heat and cold. When growth has ceased and the tissues are mature or in a resting or dormant condition and contain much less water, they are least sensitive to heat and cold. The temperature range for any individual during growth, and even in the dormant or resting condition, varies for different individuals, varieties, and species. These temperature ranges have become more or less fixed within certain limits for different individuals and species through the influence of the temperature factor in the environment under which the species or individuals have developed. Thus, plants adapted to long growing seasons of the South will not thrive in the shorter, colder season of the North. On the other hand, many plants adapted to northern conditions do not thrive in the South. When an individual or a species becomes adjusted or accustomed to the conditions and changes of a particular environment it may be unable wholly or in part to adjust its life processes to an unusual change in any factor or group of factors or the relation of these to each other. The orange, lemon, lime, and numerous other sub-tropical fruits, for example, do not have a well-defined resting or dormant period like the apple, pear, peach, etc., in the North. They would therefore be quickly killed if exposed to severe frosts.

Certain varieties of peaches and plums which survive Northern winters without injury, when planted in the South often winter-kill. Extended warm spells in the latter part of winter, and the warming effects of the sun on the south and southwest sides of the trunk start the activity of the cambium, which is subsequently injured or killed by freezing, the same as are young buds pushing out too early in the spring under the influence of warm days and then caught by the late frosts.

Varieties that start into growth readily under such conditions may be completely winter-killed if the conditions are such as to stimulate a general premature activity. If only the tissues warmed by the direct action of the sun are involved, patches of various size may be killed. These usually start near the surface of the ground on the southwest side of the tree, and extend up the trunk to the limbs, varying in width from a few inches to the whole south and southwest side.

*Winter Sun Scald.*—This term is usually applied to cases like those just described where smaller areas on the south or southwest side of trees are killed during winter by the successive warming and freezing of the tissues. This form of injury is common in the North and West. Considerable protection may be afforded in all such cases by coating the tree with whitewash or protecting it from the direct action of the sun in some way.

*Winter Desiccation.*—Evergreen trees and shrubs are often killed or greatly injured during periods of bright, warm weather in the winter by rapid evaporation of water from the leaves while the ground and roots are frozen and unable to replace what is lost.

Another form of winter desiccation is through the direct action of freezing, where, by intense

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cold, the water is drawn so completely from the protoplasm into the cell walls or intercellular spaces in the formation of ice crystals that the cells are unable to re-absorb water on thawing. This effect of freezing is similar in many respects to that of drouth. Water is withdrawn from the protoplasm to a greater or less extent, according to the duration and severity of the cold and the retaining power of the protoplasm. If the withdrawal has not been too great, and thawing process is slow so that the cells can gradually re-absorb what was given up in freezing, the plant may suffer no harm. If on the other hand, the tissues are thawed rapidly, the air is driven out of the intercellular spaces and the cells may die for want of oxygen or the water may be lost by evaporation before it can be reabsorbed. Frozen plants should therefore be thawed slowly and protected from evaporation by sprinkling with cold water or shading. While most cases of injury from freezing are due to the conditions just described, there is another class of cases where the injury is apparently due to structural and chemical changes in the protoplasm induced by the cold.

*Cold Rigor.*—As already pointed out, the sensitiveness of protoplasm of various plants and at various stages of growth differs remarkably, but in all cases during vegetative activity there is a point either a little above or below the freezing point of water where protoplasmic movement and growth cease without the cells being necessarily frozen or killed. This condition is known as cold rigor, and is often taken advantage of by florists and gardeners in holding their flowers or fruits temporarily in some particular stage of development for a particular market period. Usually when the temperature is raised the growth continues normally, but occasionally, if the temperature is a little too low and long continued, the plant fails to respond again to a higher temperature and is found to be in a state of permanent rigor or paralysis; though the plant does not die, it makes little or no growth.

*Mechanical Separation of Cells.*—In many parenchymatous tissues, leaves, bark, parenchyma, fruits, etc., which can stand considerable freezing without injury to the protoplasm, there is more or less rupture of the cells from each other by the formation of ice in the cell walls or intercellular spaces. In some cases the epidermal cells are almost completely separated from the rest of the tissue. In other cases, as in apples and bark parenchyma, the individual cells may, in extreme cases, be separated and form a powdery mass. If the separation is complete the cells die after a time. In any case, even a partial separation and breaking of the protoplasmic connections between the cells interferes with normal development, and may cause the premature death of the whole or parts of the plant by interfering with the movement of food materials, etc.

*Frost-cracks.*—These usually occur as the result of rapid freezing and shrinking of the outer tissues of trees, especially while the inner tissues are relatively warm. After the cold period is over and warmer weather comes such cracks close up.

*Frost Canker.*—This name is applied to wounds that are prevented from healing through the action of late frost in killing the callus rings as they develop. The killing of roots and the

lifting of plants from the soil by freezing are familiar phenomena to all gardeners, but further consideration of this subject can not be undertaken here.

*Scorching or Burning.*—Sometimes in hot, dry weather smooth-barked trees and shrubs may have portions of their tissue exposed to strong sunlight actually killed by the high temperature. In light-colored, sandy soils the reflection of heat from the sand often kills the lower leaves of low-growing trees, shrubs, and especially of herbaceous plants. The reflection of sun heat from the south or west side of buildings, etc., may also cause similar injury. The direct injury in such cases is often, however, confused with the effects of excessive transpiration. The burning effect of hot, dry winds is largely due to the excessive transpiration they induce. The burning is especially severe when there is an insufficiency of soil moisture as the result of drouth or lack of proper cultivation.

*Sudden Variations of Temperature.*—As already indicated, the injury resulting from changes of temperature above the maximum or below the minimum for a species or individual depends in large measure upon the rapidity of the change. If the change is slow, even the individual plant may adjust its vital processes to temperatures which would have resulted in death had they been sudden. Some of the algæ, for example, live in hot springs at a temperature of 93° C., while the original stock from which these forms were derived lives in water rarely exceeding 40° C. A transfer of individuals from 40° to 93° would result in almost instant death, while by slow, gradual change they could be accustomed to this extreme temperature. For flowering plants (Phanerogams) the possible maximum is much lower, 50° being the extreme limit, while the average limit is from 37° to 46°.

Sudden variations well within the fatal limits, however, are productive of pathological changes. A rose, tomato, violet, or almost any other plant grown at a cool temperature (8° to 15° C.), all other conditions remaining the same and then suddenly exposed to 24° to 27° C., will turn yellowish, become weak and spindling and very sensitive to insects and parasitic diseases. The same plants, started at 24° to 27° and growing normally at that temperature, if suddenly dropped to 15° or 8° become yellowish and weak and very sensitive to parasite enemies. In either case the change from one temperature to the other could be made without serious injury if made gradually and slowly. For a general discussion of this subject with references to literature, consult Davenport's 'Experimental Morphology.'

*Resting or Dormant Period.*—A resting or dormant period is more or less well defined in many perennial plants. In northern and temperate latitudes this period coincides with cold weather and has developed in response to this constantly recurring seasonal change. In other cases in hot climates a partial rest may occur during the dry season. In many cases this period of rest has come to be a necessity to the normal and healthy development of the plant. Detmer and Müller-Thurgau have shown in the case of potato tubers and many dormant buds that in the fall and early winter the tissues contain only enough sugar to meet the demands of

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respiration of the dormant cells, not enough to stimulate growth. Müller-Thurgau has demonstrated that exposure of tubers dug in August to 0° C. for a few weeks causes an accumulation of sugar sufficient to start normal germination when the cooled tubers are placed under favorable conditions. The cold reduces the amount of sugar used in respiration and probably also causes an increase of diastase, the enzyme that converts starch into sugar. The same has been shown to be true also in the case of the dormant buds of many trees and shrubs. Exposure of dormant buds, bulbs, tubers, etc., to sulphuric ether for several days has a similar effect to that produced by exposure to cold. In the case of plants that have their dormant or resting period in dry weather there is an accumulation and modification of reserve foods preparatory to the next season of growth. Buds, bulbs and tubers may often be forced to grow before they have accumulated sufficient reserve food in the proper form, but the result is usually a weak plant very subject to disease. A good example of this may be seen in the attempt that is often made to force bulbs that are immature and that have not had their normal period of rest or have been forced the previous season. Variegation or mosaic disease is also often produced in this way.

**Light.**—Practically all the chlorophyllaceous plants are dependent upon sunlight for normal development and activity. Every individual and every species is adapted or attuned to a particular range of light intensity, and suffers injury if the intensity becomes too great or too small, or if the change from one intensity to another is too sudden.

**Injury from Strong Light.**—Many bacteria and fungi, for example, *Bacillus anthracis* and *Botrytis cinerea*, grow best in darkness or very weak light, but are killed in a short time by exposure to sunlight or to artificial light strong in the blue-violet rays. It is this portion of the spectrum that causes the chemical disorganization of the protoplasm, or rather its destruction by oxidation as in the absence of oxygen during exposure no change takes place. The same is true of the more highly developed chlorophyllaceous algae and shade plants—too strong light not only destroys the chlorophyll by oxidation induced by the blue-violet rays, but the protoplasm itself may finally be thus killed or chemically disorganized. This is also well shown in the injurious effect of the ultra-violet rays in the naked electric arc light. A glass globe which cuts off these rays prevents the injury. This pathological condition in varying degrees of intensity is produced not only in shade plants when exposed to direct sunlight, but also in other plants when grown in the shade and suddenly exposed to strong light. It is also common when an extended period of cloudy or foggy weather in the spring is suddenly followed by bright, clear days. Under such conditions there is not only a partial destruction of the chlorophyll, but an excessive loss of water from the poorly cuticularized leaves. Such leaves are also unable to close their stomata quickly, which is another reason for their suffering from excessive loss of water. The action of light in promoting evaporation or transpiration is mainly by raising the temperature of the tissues above that of the surrounding air. When the air temperature is very high the increased

temperature of the tissues of plants exposed to strong sunlight is often sufficient in itself to cause injury or death.

**Injury from Weak Light.**—While too strong light can not be endured by any plant, lack of light is injurious only to chlorophyllaceous plants. When the light intensity is reduced below the minimum for any of these plants the synthesis of carbon and nitrogen compounds is reduced accordingly until in very weak light or darkness the plant can make no use whatever of the carbondioxide of the air. That the plant will starve in proportion to the reduction in photosynthetic activity is evident.

**Electricity.**—That electrical conditions of the earth and atmosphere and of the plant have an important relation to the physiological condition of the latter has been demonstrated in many cases, but the full significance of this relation is not yet understood. Plants vary in sensitiveness to electric currents in much the same way that they do to light or heat. A current above the maximum for a plant causes the disorganization and death of the protoplasm. This is often accomplished by a comparatively weak direct or alternating current, but is perhaps most familiar in cases of injury or death from currents of high intensity, as from electric light wires or lightning stroke.

**Mechanical Injury.**—Finally, among the causes of disease in the non-living environment, we have to mention mechanical injuries, such as those produced by hail, wind, falling trees, etc. Hail stones often severely cut and tear the foliage of trees and herbaceous plants, and may also produce more or less serious wounds in the more resistant tissues. Wind may injure the foliage, break limbs, etc., as may also falling trees. In all these cases, except in the most severe forms, the greatest danger comes from the entrance into the tissues of the wounded plant of parasitic insects and fungi. Large mechanical wounds, however produced, should have antiseptic treatment where practicable, especially in large and valuable trees. The injured parts should be trimmed to healthy tissue in such a manner as to favor rapid formation of callus. After a wash of some disinfectant, such as copper sulphate 1 per cent solution in water, the wound should be protected by shellac or grafting wax, or white lead paint.

### DISEASES CAUSED BY THE LIVING ENVIRONMENT.

**Struggle for Room.**—The results of crowding are so familiar and apparent that discussion of the subject is scarcely required. The strong plants occupy the soil with their roots and the air space with their leaves and branches, crowding out the more backward or weaker individuals or species. Some are thus starved to death, others are reduced in size and vigor according as they lack the proper space in which to grow.

**Plant Associations.**—Plant associations spring up controlled by certain dominant species. Each individual of such a community has its influence on the others. The shade of a tree keeps back some sun-loving species and makes it possible for shade-loving species to grow, and so, with countless inter-relationships, plant communities develop, often of great complexity. If the tree or other dominant factor is removed the changed conditions are followed by a breaking-up and readjustment according to the new conditions. Many of the former occupants of



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the area will be starved or crowded out in the struggle. Others may suffer from excess of light or too high temperature. Disregard of the natural requirements of plants and their interrelations in communities often leads to disastrous results in clearing or planting in landscape gardening.

**Symbiosis.**—This term was first used by De Bary to designate plant partnerships such as those represented by the co-operation of fungi and algae in the formation of organisms known as lichens. The fungous hyphae surround the algae cells and furnish them with water and dissolved salts from the substratum, and the algae in return supply to the fungus hyphae the required organic nutrient materials. The community forms in itself a specific vegetable organism, though under favorable conditions of nutrition both the fungus and the alga forming the lichen may live independently of each other. Another type of symbiotic relationship is found in the so-called *Mycorrhiza*, or fungus roots. These are specially common on plants growing in humus. Two types are distinguished, one where the fungus is in close external union with the roots, covering them with its filaments and preventing the formation of root hairs, actually taking their place by supplying the plant not only with water and mineral food but also with organic nutriment from the humus. These external associations are usually termed ectotrophic mycorrhiza.

*Monotropa hypopitys* is a good example of a non-chlorophyllaceous plant dependent upon ectotrophic mycorrhiza for its food. Among forest trees the phenomenon is very common, especially in the *Cupulifera* and *Abietinae*. That the fungus mantle in these cases supplies the host with food materials from the humus has been amply demonstrated. Ordinarily the host plant in these cases furnishes little or nothing to the fungus, which is able to obtain all its nutriment from the humus. In some cases, however, the Mycorrhiza fungus has been observed to penetrate the root sheath and become parasitic. It is a short step from this condition to the cases where the fungus is normally internal, forming the so-called endotrophic mycorrhiza, as in many of the *Orchideae*, *Ericaceae*, *Epacrideae*, *Empetraceae*, and representatives of other groups living in humus soils. In many of these cases, while the plants are not in any way apparently injured by the fungus, they can thrive as well without as with it, and the relation of the fungus to the host has not as yet been fully investigated. Among the *Leguminosae*, however, the case is different. All legumes in their native soils have their roots covered with "tubercles." These develop as the result of stimulation produced by certain bacteria which enter the young roots through the root hairs and grow symbiotically within the cells. The bacteria draw their organic nourishment from the stores in the root, and in return secure nitrogen directly from the atmosphere which afterward becomes available to the legume. Legumes with these tubercle bacteria can thrive in a soil absolutely devoid of nitrogen, whereas, without the bacteria, they could not live at all in such a soil. The failure of legumes to thrive in certain soils is often due to the absence of these tubercle organisms. On the other hand, the tubercle organism often degenerates into a mere parasite. Similar organisms are also

found in symbiotic relation in the alder and in several other groups of plants.

**Vegetable Parasites.** The true vegetable parasites (obligate parasites) are those which can not, in any phase of existence or stage of development live independent of the host plant. There are many true parasites both among the higher and lower orders of plant life. Many organisms, however, are parasitic during certain stages of their development, and saprophytic in other stages; where the parasitic nature is predominant they are called hemi-parasites; if the saprophytic phase predominates they are classified as hemisaprophytes. All of these classes are responsible for the production of diseases of various types. The true saprophytes, which live entirely on dead organic matter, are seldom the cause of diseases. The diseases of plants due to vegetable and animal parasites constitute by far the larger number of diseases and are those of greatest economic importance. In some cases, as previously suggested, it is difficult to determine whether we are dealing with a harmless symbiotic relationship or one where the host is more or less injured. In this doubtful category, for example, are to be placed the mistletoes (*Loranthaceae*). These plants possess leaves containing chlorophyll, and are related to their host the same as a scion to a stock. The true mistletoe of Europe (*Viscum album*) and its relatives in America (*Phoradendron flavescentis*) are parasitic on a great variety of deciduous trees, and sometimes do considerable damage. Here also must be placed those endotrophic mycorrhiza of many plants growing in humus where neither benefit nor injury has been shown as a result of the presence of the fungus in the roots. Among the phanerogams, however, there are many true parasites, for example, the *Orobanchaceae*, which are devoid of chlorophyll and derive all their nourishment from the roots of the host plants to which they are attached. These parasites often do considerable damage to tobacco, hemp, lucerne, clover, and other crops. The Dodders (*Cuscuta*) are also true phanerogamic parasites, deriving all their nourishment from their host plants, which they overrun and penetrate with their sucker roots (haustoria). The most dangerous and prolific disease-producers, however, are the pathogenic fungi and bacteria.

**Pathogenic Fungi.**—The consideration of diseases caused by pathogenic fungi is usually based upon the fungus, and the genetic relationships of the fungi usually determine the order in which the diseases are discussed.

While this practice is undoubtedly the best one to follow in a systematic treatise, it is probably the cause of the erroneous impression sometimes encountered that the fungus is the disease. The disease is the functional or cell derangement of the plant or part of the plant. The same functional or cell derangement, and therefore strictly the same disease, may in some cases be produced by a great variety of totally unrelated causes. More attention should be given in plant pathology to the study of the disease itself, though not less attention should be paid to the determination and study of the cause. This latter course is especially necessary in the case of the pathogenic fungi, bacteria, or insects. A complete and accurate knowledge of the life history and nutritive requirements of pathogenic organisms furnishes



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the best foundation on which to base the procedure for preventing or controlling the diseases caused by them. As already suggested, there is every possible gradation among the pathogenic fungi, between the strict saprophyte (such as sooty molds), causing disease only by chance association, and the strict parasite (such as rusts and smuts), unable to exist independently of their living hosts.

Among the diseases caused by strict saprophytes may be mentioned the starved and chlorotic condition of many leaves and fruits due to the presence of sooty molds on their surface. These black, mold-like fungi grow in sugary excretions, especially the "honey dew" excreted by insects, aphides, scales, leafhoppers, etc. This black growth, where it covers the surface of leaves, occasionally cuts off so much light that the chloroplasts lose their green color, and the formation of starch and sugar is so greatly reduced as to cause partial starvation and general retardation of growth of the whole plant. This is intensified by the injury produced and the food removed by the insects.

Many of the saprophytic yeast fungi, molds, and bacteria cause fermentive decomposition in the weakened and dead cells of the wounded tissues, especially those rich in sugar or other reserve materials. Toxic products are thus produced which weaken or kill all the cells absorbing them. Such fermentations are especially common following mechanical injury to ripening fruits and to the sapwood of trees, in the latter case particularly following the work of borers. Fungi of this class grade imperceptibly into the hemisaprophytes or facultative parasites which start their vegetative development in dead or weakened tissues like the heartwood of a tree or the dead tissue of a wound, and then gradually spread into the living tissues, killing them. The best examples of this class are the wood-destroying *Polyporeæ* (bracket fungi), *Agaricineæ* (toad stools), and related fungi. When these get into the heartwood through a wound, or into an area of dead cambium bark or sapwood, they first fill the dead area with their mycelium and gradually spread into surrounding living tissue, in some cases by secondary action through decomposition products, or by cutting off the water or food supply from the living tissues, or by primary action, where the mycelium spreads from its saprophytic vantage ground directly into the neighboring living tissue.

In order to prevent wound infection of woody plants it is necessary either to keep the surface of the wound dry, preventing the exudation of sap and the entrance of water by searing with a hot iron, or by treating the injured surface with an antiseptic or protective coating, paint, or wash, such as coal tar, white lead, copper sulphate, etc.

Besides the hemisaprophytic wood-destroying fungi which gain entrance through wounds and are not able otherwise to infect a sound plant, there are others of the same class, such as *Agaricus melleus*, whose mycelial strands or rhizomorphs are able to work their way through the sound bark of numerous conifers, underneath the bark and in the wood of which the fungus produces dense white, felt-like mycelial membranes. These kill the bark and wood and stimulate an excessive flow of resin into the injured parts, finally resulting in the death of

the tree. This same fungus also attacks deciduous broad-leaved trees, but here it is more particularly a wound parasite.

*Botrytis*, *Pythium*, *Sclerotinia*, and many other fungi, though able to pass the whole of their existence as saprophytes, are also able under favorable conditions to infect the living tissues of plants and destroy them. It is a short step from these fungi to those of a slightly more decided parasitic nature, the *hemiparasites*, organisms which can not in nature complete their life history as saprophytes. The *Ustilagineæ* (smuts) are among the most familiar examples of this class. These grade imperceptibly into the strict parasites such as the *Uredineæ* (rusts), which can not live at all as saprophytes.

Among the strict parasites there is often a high degree of specialization, a given species of fungus being restricted in many cases to a particular genus or even species of plant. In some of the rusts there is a peculiar phenomenon of this nature known as heteroecism. Many species of rusts go through their whole life history producing all their various forms of spores on the same host. In other cases, however, spermatia and æcidiospores are produced on one host and the uredospores and teleutospores of the same fungus are produced on an entirely unrelated host.

*Injury Caused by Parasitic Fungi.*—It is extremely difficult to classify the various reactions of plants to parasitic attack. Every case has to be considered in a large measure individually. There are, however, certain general types of reaction and injury that may be noted. There are many parasitic fungi, for example, that attack the leaves of plants; some of these, like the powdery mildews, grow only on the surface of the leaves and younger stems, forming powdery, whitish spots or coatings and drawing nourishment from the surface cells by sending down into them short, root-like growths, *haustoria*. When these surface parasites attack the young growing leaves, stems, or fruits, the areas occupied by the fungus are greatly retarded in development, often causing more or less distortion of the leaves, and in severe cases often killing them and causing early defoliation. The flowers and fruit may thus also be destroyed. The proper ripening and maturation of the wood of perennials is often so much retarded by these direct and indirect effects that it winter-kills. When these fungi, however, attack only a few leaves on a plant, or where they attack the leaves after they are full grown, the injury is comparatively slight. Prompt burning of the fallen leaves in autumn is one of the best preventive measures. Sulphuring, so widely practised in the case of vine mildew, helps to rid plants of the fungus, and spraying with Bordeaux mixture is a good preventive as well as curative treatment.

Besides these external parasites there are a large number which penetrate and vegetate directly in the cells or in the intercellular spaces of the host. Some of these after a time kill the tissues in which they are growing, producing a dead area. If these dead areas are in the leaves and are numerous or large, the value and working power of the leaf may be seriously impaired or destroyed altogether. The destruction of the first crop of leaves often results from the attack of leaf-spot fungi early in the summer, and the plants are obliged to put out a

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second crop of foliage. This must be done at the expense of reserve food stores. In such crops as sugar beet, Irish potato, etc., this use of reserve food becomes evident in the reduction of yield of tubers and sugar. In crops like beets and potatoes, where there is a continual succession of new growth, a second attack is not so serious as in the case of trees and shrubs where two successive defoliations either kill the plant outright or so weaken it that it winter-kills or dies of starvation. The weakening effects of premature defoliation are often not fully realized. Where one premature defoliation has occurred from any cause, great effort should be made to protect the second crop of leaves and to stimulate the plant with nitrogenous fertilizers. If the plant is a perennial, some protection, if possible, should be furnished during winter, as the wood is likely to be poorly ripened. Practically all the leaf-spot diseases are easily controlled by spraying the foliage with Bordeaux mixture or other good fungicide. Immediate removal, if possible, and burning of the diseased leaves also serve to hold these diseases in check.

If prompt action of this kind is taken when the trouble first appears it may often be checked without other treatment. It is safest, however, to spray other plants with a fungicide whenever practicable.

Many fungi which may start by attacking the leaves are not limited to them, but spread to or even directly attack the stems. The *Peronosporae*, or downy mildews, are good examples of this class. Plants which have developed in moist, cloudy weather are particularly sensitive, and the parasite starting in leaves or stems may in a few days invade all the tissues of the plant, causing a rapid soft rot. The well-known "potato rot," often causing the complete destruction of the crop in a few days, is caused by one of this group of fungi. Many other crops are similarly affected by fungi of this group. Like the leaf-spot fungi, these are easily prevented from gaining entrance to the tissues of plants by keeping them well sprayed with Bordeaux mixture or other good fungicide.

The root rot and damp-off fungi—*Rhizoctonia*, *Ozonium*, *Agaricus melleus*, *Botrytis*, *Pythium*, *Fusarium*, etc., usually attack the plant through the roots or base of the stem, and cause a more or less rapid decay of the invaded tissues, followed by the starvation and death of the whole plant.

The cultivation of resistant individuals or the use of uninfected or sterilized soil and attention to general cultural conditions, especially rotation of crops, drainage, and aeration of soil, are the best preventive measures for diseases of this type.

In other cases stems and leaves may be invaded by fungi (rusts or smuts), but rotting or sudden death of the tissues does not occur. The plants may, however, be so reduced in vigor that they fail to mature. The cereal rusts, for example, often greatly reduce the yield of grain. In case of the smuts the grain is replaced by the spores of the fungus, but the plant is apparently not otherwise injured.

**Hypertrophy.**—In some cases the tissues attacked by fungi are stimulated to excessive growth. Finger and toe disease of turnip roots caused by *Plasmodiophora*, plum pocket and "leaf curl," "witches' brooms," etc., caused by

*Exoascus*, the large galls on *Vaccinium* and *Rhododendron* caused by *Exobasidium*, the large swellings produced on conifers by *Peridermium*, etc., are good examples.

**Pathogenic Bacteria.**—The casual relation of bacteria to numerous animal diseases has been the subject of much careful study, but until recently there were only a very few plant diseases known to be caused by these organisms.

Among the best known examples may be mentioned the "fire blight" of pomaceous trees, especially pear and apple. The tops of the trees are killed back as if burned by fire. The bacillus causing the trouble is carried from tree to tree by bees and other insects. The principal infection is through the nectaries of the flowers, and possibly, also, through the glands or water pores of the young leaves. The twigs are usually killed back for a few feet, then as the wood begins to mature the bacteria usually die, except where they have invaded a large limb or the body of the tree. To prevent the disease being carried over from season to season it is necessary only to find and remove all these latter sources of infection.

A bacterial disease of the English walnut on the Pacific coast is a serious menace to the culture of these trees. A bacterial gall or tumor of olive trees is serious in Europe, and has appeared in some of the olive groves of California. Among the bacterial diseases of vegetables may be mentioned the bacterial rot of the tomato, egg plant, and Irish potato, carried by biting insects, the brown rot of cabbages, and a bacterial disease of sweet corn entering the tissues through water pores in the edges of the leaves. Numerous other plant diseases have been shown to be due to bacteria, and the number will probably be greatly increased as the field is more carefully worked.

**Diseases Caused by Animals.**—Next to diseases of vegetable origin, those caused by animals, especially insects, are the most numerous and destructive. Many fungus and bacterial diseases are carried from plant to plant by insects; for example, pear blight by bees, potato rot by potato beetles, ferment and wood-rot fungi by boring beetles, etc. In the case of pear blight the bees, though they are carriers of the disease, are beneficial to the trees in aiding pollination. In other cases the injury caused by the insects may in itself be serious. The biting insects may in some cases cause more or less complete defoliation, or the sucking insects and mites may so reduce the stores of plant food as to seriously interfere with growth. Among the best known and most injurious of these are the scale insects, mealy bugs, plant lice (*Aphidae*), leaf hoppers, and the "plant bugs" (*Capsidae*). All of these feed on the sap of the plant by sucking it out of the tissues, but causing little or no mechanical injury to the cells. In many cases there is simply a general or local retardation of growth due to the removal of sugars and proteids; in other cases irritations are set up, possibly by some material injected into the tissues by the insect, resulting in gall-like swellings or various hypertrophied developments of the parts attacked, for example, *Phylloxera* on the leaves and roots of grape; woolly apple louse (*Schizoneura*) on roots of apple; *Colopha*, cockscomb gall on elm, etc. In other cases the growth of the tissue is checked, as where tis-

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sues are attacked by scale insects such as San José scale, and by many of the plant lice and leaf hoppers. In other cases growth is neither checked nor accelerated, but definite spots are produced which continue to enlarge, resembling a fungus or bacterial infection (*Stigmonose*) or puncture diseases, etc.

Borers may more or less completely ring a tree, cutting off the connection between root and leaves and thus resulting, in many cases, in death. Hypertrophy of tissues is also often the result of insect attack. Many insect larvæ developing from eggs laid in young tissues cause, by the irritations they set up, growths known as galls. Nematode worms attacking the roots of plants also cause gall-like swellings.

As in the case of the fungi, the complete life history and habits of any particular injurious insect must, as a rule, be determined before the greatest success in controlling it can be attained. Many insects have their natural enemies, which, if favored, may hold a serious pest in check. The development of natural resistance in plants by selection is also an important means of preventing injury in certain cases. And finally, the use of insecticides must be resorted to, as arsenic, etc., for biting and eating insects, and contact poisons for sucking insects.

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**Disentis**, Switzerland, a village in the canton Grisons, situated on the Hither Rhine. It is about  $31\frac{1}{2}$  miles southwest of Reichenau, and 3,600 feet above sea-level. The monk Sigisbert, a disciple of Saint Columba, is supposed to have founded a large Benedictine monastery here in 614. Pop. (1900) 1,400.

**Disestablishment**, specifically the depriving a Church of its rights, position, or privileges as an established Church; withdrawing a Church from its connection with the State. A bill for the disestablishment of the Irish Church was introduced into the British House of Commons by Gladstone 1 March 1869. It was passed by Parliament within a few months of its introduction but did not take effect till 1 Jan. 1871.

**Disfranchisement**, the act of depriving a person of any privilege, liberty, franchise, or immunity, such as depriving a member of a corporation of his corporate rights. It is distinguished in this case from "amotion," which refers to the removal of an officer of the corporation from office, without affecting his membership. Another instance is the act of depriving a person of the rights and privileges of citizenship. This term is often applied to the act of depriving a citizen of the right to vote, and in Great Britain to the Act which deprives a constituency of the right to return a member to Parliament.

**Dishonor**, the refusal or omission of the drawee of a bill to accept, or of the acceptor of a bill, or of the maker of a promissory note to liquidate the obligation, on its maturity. There are generally three parties in a bill or note transaction, the holder, the drawer, and the person by whom the bill or note is payable, whether he be the maker or acceptor of it. In case the bill or note is dishonored, the holder must at once notify the endorser and the drawer,

if the paper be a draft or bill. Then the drawer, if there be funds of his in the hands of the drawee, will have an opportunity of withdrawing them. If a banker refuses to pay a customer's check, while holding an account of that customer sufficient to meet such check, he makes himself liable for damages.

**Disinfectants**, agents used for destroying or rendering inert the germs of infectious diseases. It has been amply proven that a large number of diseases are of microbic origin, and when these low forms of micro-organisms are introduced into the body of susceptible individuals they multiply and thereby become capable of producing certain diseases, which are called infectious. Any agent capable of destroying these organisms is a disinfectant or germicide, and through disinfection we have a powerful and effective means of controlling these diseases and checking the spread of them.

In order to disinfect thoroughly, we must first trace the source of infection. In the eruptive fevers, such as measles, scarlet fever, small-pox, etc., the infectious agent comes directly from the body, attaching itself to the clothing, bedclothes, etc., and to objects handled by the infected person. The same is true of infectious skin-diseases, such as barbers' itch, ringworm, etc. In pneumonia, tuberculosis, diphtheria, and whooping-cough, the sputum and the breath take the germ of infection; in cholera, the alvine discharges, and possibly vomitus; in typhoid fever infection is largely due to the specific germ found in the discharges from the bowels; in malaria, anthrax, and elephantiasis, the germ is found in the blood; in hydrophobia it occurs in the saliva, spinal cord, and brain; in gonorrhoea, in the urethral discharges, etc. Some of the infecting agents do not multiply outside of the body, while others under favorable conditions are very procreative; therefore the object of disinfection is to destroy all infected material and, where this is not admissible, to subject it to a process of disinfection inimical to the life of the infecting germ. This must be complete and thorough. The selection of an appropriate disinfectant for each germ is the result of laboratory research. A culture of a germ is made in a medium best adapted to its propagation, and by experimenting with various agents one (or more) is found which proves most destructive to the germ, in the shortest possible time. The best and cheapest disinfectants known are supplied by nature, namely, sunlight and air.

Fire and heat are the most powerful disinfectants known. In the use of heat various kinds of mechanical apparatus for both dry and moist (superheated steam) heating are used. Boiling infected clothes, with or without the addition of a chemical disinfectant, is a popular means of disinfection. Where it is impossible to use either of these agents, gaseous elements are introduced. Cold (freezing) is a natural disinfectant, but fails in the case of typhoid germs, which have been known to resist freezing after 103 days; and the same is true of the tuberculosis germ. Camphor, medicated papers, or the burning of incense, may clear an odorous atmosphere impregnated with sewer-gas or fumes of decomposing animal or vegetable matter; but these are not disinfectants.

## DISINFECTION — DISLOCATION

Of late the utility of disinfection has been forcibly demonstrated, and most cities and quarantine stations have established plants for steam disinfection. Clothing, bedding, etc., known or believed to be infected are placed in chambers or cylinders and subjected to a pressure of superheated steam (220° to 230° F.) for 20 or 30 minutes. This thoroughly disinfects all infected material. Dry heat is not so effective. The ideal disinfectant for all practical and domestic purposes, both inexpensive and easy of application, is chloride of lime in the proportion of six ounces to a gallon of water. All typhoid or cholera stools, likewise the sputum of pneumonia or tuberculosis patients, are rendered innocuous by it in less than 30 minutes. Carbolic acid in the proportion of four ounces to a gallon of water will destroy most bacilli, but not their spores. It is highly poisonous, and very destructive to the skin, therefore to be used with caution. Corrosive sublimate, in proportion of one part to 1,000 parts water, is not only an efficient disinfectant, but a powerful insecticide as well. It can be applied to wood-work, walls, floors, etc., but its corrosive action on metal renders its uses limited on sewers, drains, and the like. Milk of lime or common whitewash, so highly recommended by the German government in the cholera epidemic of 1892, is a ready and efficient means of disinfection. This may be prepared by sprinkling a quart of quicklime in a suitable vessel and, when the lime is reduced to a powder, adding three or more quarts of water, allowing the mixture to stand. It may then be applied with a brush to walls, floors, etc. Drains are flushed, and all excreta from infected cases treated with equal parts of lime solution.

The use of chlorine and sulphurous gases is objectionable because of their irritating qualities. Sulphur fumes are falling into disuse, in consequence of the foul odor and failure to accomplish the end sought. A more modern disinfectant is made by subjecting methyl-alcohol to oxidation, and is commonly known as formalin. It is readily soluble in water, does not destroy clothing or furniture, and is virtually non-poisonous. It is used in the preservation of meat and food, for disinfecting surgical instruments, for the washing out of sinuses and of indolent and foul ulcers, and for the disinfection of dwelling-rooms. Solid formaldehyde being introduced into a generator and burned, the resulting gas quickly penetrates all cracks and crevices, and renders the air clean and pure, besides destroying all infectious germs.

Most of the metallic and acid disinfectants are more or less objectionable on account of their destructive action to the skin and tissues. Permanganate of potash, osmic acid, bromine, and iodine are useful in their respective places. In all cases of infectious or contagious diseases disinfection should be complete; articles infected should be burned, boiled, or disinfected, and not buried or thrown into sewers before being treated with a proper disinfecting agent, for infecting germs have been known to lie dormant for years.

**Disinfection**, popularly speaking, the process of destroying infectious organisms. Various modes of general disinfection have been in use for a number of years, most of which are extremely crude and inefficient. It is be-

coming recognized more and more that a general mode of procedure for dealing with infectious organisms is of very little value, and it is becoming more and more evident that individual disinfection for each and every type of disease-producing organism is necessary. Thus the old-fashioned mode of disinfection in yellow fever, by means of steam, heat, chlorine gas, sulphur, etc., are shown to be absurd in the light of modern knowledge, as yellow fever is conveyed by means of mosquitoes, and as the knowledge concerning the cause of infectious diseases is becoming more and more definite, the means of preventing the spread of such diseases by proper disinfectants is taking on a more individual character. In any application of the principle of disinfection the first question necessary to ask is, by what agents and through what channels is a given disease propagated? Thus in diphtheria, it may be vastly more important to cleanse the throats of all persons who have come in contact with a diseased patient, than it would be to burn barrels of sulphur in a room where a sick child had lived. In typhoid fever it is now well recognized that the bacillus of the disease is eliminated in the feces and in the urine, and that flies and small animals are capable of carrying about on their feet the micro-organisms. Therefore if one would properly disinfect a typhoid fever patient, it is necessary to take great care with the feces and urine and other excreta, and, as far as possible, exclude all insects from the room. Of the value of general disinfectants, such as the burning of sulphur in a room, or the use of formaldehyde gas, or the cleaning out of ships and railway cars by aerial disinfectants, the writer believes them to be generally inefficient.\* In this encyclopedia individual prophylaxis against contagion is described under each infectious disease, and can best be consulted in its proper place. See ANTISEPTICS; BACTERIA; DISEASE; GERMICIDES; INFECTIOUS DISEASE.

\*The best disinfectants are fresh air and sunlight. Steam, boiling water, and burning are the best means of cleansing clothing. Formaldehyde gas is one of the best means of ridding a large room from noxious insects, and as a general disinfectant.

**Disintegrator**, a machine in which various substances are pulverized or crushed by beaters projecting from the faces of parallel metallic disks revolving in contrary directions. There are disintegrators for ore and for grain, and one form is used for mixing mortar.

**Dislocation**, the displacement of one bone from another with which it forms a joint. Thus by dislocation a limb is said to be put out of joint. Dislocations are the result of either disease, accident, or congenital malformation. The displacement may be either partial or complete, and cases are classified as simple, when the skin remains unbroken, and compound where a wound lays bare the bone; when a fracture of the bones, and injury to important blood vessels aggravates the case, the dislocation is said to be complicated.

The general treatment of dislocations consists in reduction, that is, drawing back the displaced joint into its socket. The contracted muscles oppose this reduction, and sometimes their spasmodic action has to be overcome by the administration of chloroform or ether. Up to the year 1870 or thereabouts the reduc-

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tion was generally effected by extension, that is, by pulling out the displaced limb, and stretching the restraining muscles until they are exhausted, when the bone would generally slip back into its place with an audible snap.

Of late years, however, reduction by extension has been to a very large extent given up in consequence of the general adoption of reduction by manipulation. This method, known it seems from ancient times, but curiously neglected, consists in executing certain complex movements of the dislocated limb which effect the return of the displaced bone to its socket by ingeniously utilizing its unruptured attachments and evading the opposition of the muscles, by fraud rather than by force. It is particularly applicable to the hip, which, as it is commanded by the strongest mass of muscles in the body, always presented the most formidable obstacles to the old method. The first paper on this subject which attracted general attention was by Dr. Reid of Rochester, N. Y. (1851); and in 1869 Prof. Bigelow of Boston published a careful and exhaustive discussion of injuries to the hip, with such full and clear directions for the manipulation method, as to secure its general adoption in the case of this joint by surgeons in Great Britain as well as in America. The method, however, had been described and used in France and elsewhere, though with less care and precision, in the earlier half of the 19th century.

In cases of congenital dislocation of the hip bone and other congenital misplacements of the bones, manipulation, intensified into powerful massage, has been developed practically to a wonderful extent by Dr. Adolf Lorenz, an Austrian surgeon who has lately visited this country. See LORENZ, ADOLF.

**Dislocation** (in Geology). See FAULT.

**D'Isly, Duke**. See BUGEAUD, THOMAS ROBERT.

**Dismal Swamp, Great**, a tract of marshy land, beginning a little south of Norfolk, Va., and extending into North Carolina; containing 150,000 acres; 30 miles long, from north to south, and 10 miles broad. This tract was entirely covered with trees, with almost impervious brushwood between them, but it has now in part been cleared and drained and is devoted to agriculture. In the midst of the swamp is Drummond's Lake, seven miles in length, the scene of Thomas Moore's 'Lake of the Dismal Swamp.' In 1899, the Dismal Swamp canal, connecting Chesapeake Bay with Albemarle Sound, which from about the beginning of the 19th century to the close of the Civil War was a famous historic waterway, was reopened for navigation. It extends from the village of Deep Creek, Va., to South Mills, N. C., a distance of 22 miles; and is one of the most important links in the chain of inland waterways extending along the coast from New York to Florida. A marked advantage of the restored canal is that it enables shipping to avoid the dangers of Cape Hatteras; another is that it will furnish the means of inland and protected navigation for the smaller vessels of the navy and the revenue service. Although only 22 miles long it opens up 2,500 miles of inland navigation. The improvement of this canal cost the United States government nearly \$1,000,000. Little Dismal and several smaller swamps are

along the coast of North Carolina; area, about 2,000,000 acres.

**Dismas, Saint**, according to ancient legends, based on doubtful authority, the name of the penitent thief who died on the cross beside Jesus Christ.

**Dispart'**, the difference between the semi-diameter of the base ring at the breech of a gun and that of the ring at the swell of the muzzle. On account of the dispart the line of aim makes a small angle with the axis, so that the elevation of the latter above the horizon is greater than that of the line of aim. In modern guns the dispart is of little practical consequence on account of the present placing of the sights.

**Dispensary** is literally a place where medicine or food is weighed out for distribution; in our own day the term is applied to a charitable institution where medical and surgical aid are given without charge to those who desire or need them. Such dispensaries are found in most large towns of the United States and Europe. In the Old World they originated in the monasteries. The Royal General Dispensary, Bartholomew Close, London, is the oldest dispensary in England and was founded in 1770. The oldest in the United States was opened in New York in 1795.

**Dispensation**, in canon law, is the relaxation of a law in a particular case: it is an act for which the lawgiver is competent as regards laws enacted by himself or by his predecessors to whose powers he succeeds. It is claimed for the Supreme Pontiff that he can dispense in matters where the *jus divinum* springs from a human act of will, as in vows and promissory oaths (Liguori): in such case casuists hold that the Pope does not do away with the *jus divinum* but removes the ground of the obligation of oath or vow: in the words of Aquinas, "He determines what is pleasing to God." The claim of power in the Pope to do this rests on the power granted to St. Peter, of loosing and binding. Bishops by their ordinary power can dispense from the laws and statutes of their own diocese, and from general laws of the Church by virtue of powers delegated by the Pope, as in most vows and in the laws relating to fasts, abstinences, observance of holidays, etc.

**Dispensatory**, a work of reference, concerning itself more particularly with the subject of materia medica and therapeutics. Dispensatories are not official volumes, such as pharmacopœias. They represent solely the opinions of scholars who are hired by publishers to issue at more or less regular intervals such works of reference. They are usually encyclopædic in character. At the present time there are two recognized dispensatories widely in use in the United States, the 'National Dispensatory' and the 'United States Dispensatory.'

**Dispenser**, dē-spēn'sēr, Hugh le, English jurist: b. about 1210; d. Evesham 4 Aug. 1265. He was justiciar of England in 1261 and during the war of the barons with Henry III. joined the former. He was killed at the battle of Evesham.

**Dispersion**, an optical term applied to the angular separation experienced by the component rays of a pencil of light on emerging from a refracting medium, whose surfaces are not



parallel to each other, as in the case of the common prism. The refractive index of a transparent medium is different for different kinds of light. Thus, when white light passes through a given prism, the rays of different refrangibility of which it is composed are bent by different amounts from their original common direction. They are said to be dispersed. The dispersion for the given prism depends upon the difference of the refractive indices of the extreme rays of the visible spectrum. It varies with the substance and the angle of the prism. The relative breadth of any two parts of the spectrum varies with the substance of the prism. This constitutes the so-called irrationality of dispersion. In general, rays of short wave-length are more refracted than rays of long wave-length, but in some refracting media this law breaks down in part. This is known as anomalous dispersion. The term false dispersion is applied to the scattering of light by reflection from motes suspended in a transparent medium. See LIGHT.

**Displayed**, a heraldic term used to describe the position of an eagle or other bird with its wings expanded.

**Dispossess**, in law, to put out of possession, to dislodge and evict; to deprive of actual occupancy, particularly of real property. Dispossess *proceedings* are begun against a tenant who is then served with a dispossess *warrant*, and ejectment from the premises follows. See EJECTMENT AND EVICTION.

**Disraeli**, dīz-rā'li, Benjamin. See BEACONS-FIELD.

**D'Israeli**, Isaac, English author: b. Enfield, Middlesex, May 1766; d. Buckinghamshire 19 Jan. 1848. His father, Benjamin D'Israeli, was the descendant of a family of Spanish Jews which had settled at Venice in the 15th century to escape the persecutions of the Inquisition. In 1791-3 appeared his 'Curiosities of Literature,' the most entertaining of his works, and that by which he is best known at the present day. Its success was such as to determine D'Israeli to pursue the same path through the literary field, the collection of instructive and amusing gossip relative to literary men and their writings. From this period up to 1812 he appears to have been principally engaged in the collection and preparation of literary materials, the results of his labors appearing in the following works, published between that year and 1822: 'Calamities of Authors'; 'Quarrels of Authors, or Memoirs of Literary Controversy'; and 'Inquiry into the Literary and Political Character of James I.' These were afterward published collectively under the title of 'Miscellanies of Literature.' In 1828 appeared the commencement of his 'Life and Reign of Charles I.,' a work completed in 1831. In 1841 appeared his 'Amenities of Literature.' D'Israeli was a man of a pensive and solitary turn of mind, and his life was quite that of a literary recluse, spending the greater part of his time in his library. A memoir of him, prefixed to a new edition of his 'Curiosities of Literature,' was published by his son, Benjamin Disraeli, afterward Earl of Beaconsfield (q.v.).

**Disruption**, the name commonly applied in Scotland to the act by which, in 1843, about 400 ministers gave up their livings to vindicate principles which they held to be essential to the

purity of the Church, and in harmony with its earlier history. They held themselves at liberty to return when the Church which they had left had abandoned the opinions on civil and ecclesiastical government which had caused the rupture. See FREE CHURCH.

**Dissection**, the process of studying the parts or organs of animals or plants by cutting or tearing operations. Practically, no complete knowledge of the structure of organized bodies can be obtained in any other way than by complete dissection, and in human anatomy its place in the curriculum is most important. The dissection of human bodies in the study of anatomy has probably taken place as long as we know the history of civilization; although, in certain countries and at certain ages, the practice of human dissection has been forbidden by certain ruling classes,—at one time the Church, another time the state, another time the aristocrat, at another time public opinion. At the present time, however, dissection of the dead body is recognized to be a prime essential to the study of medicine, and throughout all civilized countries it is widely practised.

**Dissection Wounds**, wounds made by cutting instruments, during the process of dissection, which differ from ordinary wounds of accidental origin, largely in their greater liability to become infected by pus-producing bacteria. The human body after death makes an excellent host for a number of these septic organisms, notably the staphylococci and streptococci. It is by the entrance of these usually present organisms into the wounds that this ready infection takes place. Often dissection wounds prove fatal by the extension of the infection, with resulting blood poisoning. Great care should be taken by all students of anatomy as well as by undertakers and their assistants in order to avoid accidents of this kind. See SEPTICÆMIA.

**Disseizin**, dis-sē'zīn, or **Disseisin** (Fr. *dessaisir*, to disseize, deprive of), is the dispossessing one of a freehold estate, or interrupting his seizin. Under the feudal law, when a vassal was admitted to an estate by the ceremony of investiture, he was said to be seized of it. The disseizing of him was the turning him out of his fee. This term is synonymous, in modern law, with "adverse possession." There is also what is called in law disseizin by election, when a property holder chooses to consider himself disseized of certain real estate, in order to avail himself of remedies at law applicable only to a disseizee.

**Disseminated Sclerosis**. See MULTIPLE SCLEROSIS.

**Dissenters**, the common name by which in Great Britain all Christian denominations, excepting that of the Established Churches, are usually designated, though in acts of Parliament it generally includes only Protestant dissenters, Roman Catholics being referred to under their specific name. The most important bodies of English dissenters are the different bodies of Methodists, the Congregationalists, and the Baptists; and of Scotch dissenters, the United Free Church. The term nonconformists is often used as synonymous with dissenters. For its historical significance, see NONCONFORMISTS.

**Dissepiment**, a division of the ovary; a true dissepiment is formed when the carpels are



## DISSOCIATION

so united that the edges of each of the contiguous ones by their union form a septum. Each dissepiment is formed by a double wall of two laminae: when the carpels are placed side by side, true dissepiments must be vertical and not horizontal. A spurious or false dissepiment is formed when the divisions are not joined by the union of the edges of contiguous carpels. They are often horizontal, and are then called phragmata. In the Cruciferae they are vertical.

**Dissociation**, in chemistry, is the resolution of a substance into other substances, whose molecules have a simpler constitution; but the word is usually applied only to those reversible resolutions in which the secondary products are capable of recombining to form the primitive substance, when the conditions that led to the dissociation are removed or reversed. Dissociation is therefore to be contrasted with "decomposition," for the latter word is used without any implication as to the subsequent behavior of the products into which the primitive substance is resolved. Dissociation, in the usual sense of the word, is induced directly by the application of heat, and many cases of it have been exhaustively studied. Calcium carbonate may be taken as an example. When this substance is heated in a closed vessel it parts with a portion of its carbon dioxide and becomes reduced to a mixture of calcium oxide, calcium carbonate, and free carbon dioxide gas. The decomposition proceeds only up to a certain limit, however, and if (as in "burning" limestone for the production of quicklime) it is desired to reduce the carbonate of calcium entirely to the form of the oxide, it is necessary to provide for the removal of the carbon dioxide gas. If the operation be carried out in a strong closed vessel which contains nothing but calcium carbonate, calcium oxide, and carbon dioxide, the decomposition proceeds only until the liberated carbon dioxide attains a definite pressure called the pressure of dissociation, which is always the same for the same temperature, and bears no relation to the quantity of calcium carbonate that is present, provided some quantity of it (no matter how little) still remains. Sir James Hall showed, many years ago, that when calcium carbonate is confined in this way it may even be fused without undergoing decomposition to any considerable extent. The explanation of these curious facts is, that the carbon dioxide is continually combining with the calcium oxide in certain parts of the vessel with the production of calcium carbonate, while in other parts of the vessel the calcium carbonate is simultaneously dissociating into free calcium oxide and free carbon dioxide. The recombination proceeds with a velocity that is proportional to the density of the free gas, while the dissociation proceeds with a velocity which, for the purpose of illustration at all events, may be regarded as constant. It follows that at low densities of the gas the dissociation will proceed faster than the recombination, the result being that the density of the free gas will increase. But this will also cause the recombination to proceed faster, and finally, when the density of the gas reaches a certain critical value, the recombination and dissociation will proceed with equal velocity, and a state of apparent equilibrium will be attained. No further visible decomposition of the carbonate will take

place, unless the equilibrium is disturbed by the removal of some of the carbon dioxide (in which case the dissociation will again proceed until the same critical density of the free gas is restored), or by a further increase of temperature (in which case the dissociation will proceed until the density of the gas attains to a new critical value, higher than the first one, and whose value depends upon nothing but the new temperature to which the system has been raised). Reactions such as the one here described thoroughly refute the old doctrines of chemical affinity, which taught that two substances either will or will not combine under given circumstances, according as the chemical "affinities" of the constituent elements would be more or less thoroughly "satisfied" in the possible new compound than they are in the separate substances that might combine to produce that compound. In the case considered above, combination and decomposition go on simultaneously, and the only question is, which of the two will proceed the faster under given conditions. (See *EQUILIBRIUM, CHEMICAL*.) The quantitative study of the phenomena of dissociation is beset with difficulties, for the extent of the dissociation cannot be ascertained with satisfactory precision in all cases. The products into which the primitive substance is resolved are (by the definition of dissociation) capable of recombining when the conditions that lead to the dissociation are removed. Hence it is by no means easy to determine what proportion of a compound is dissociated under given circumstances. When (as in the case of calcium carbonate) the primitive substance and one dissociation product are solid, and the other dissociation product is gaseous, the extent of the dissociation may be inferred by computing the mass of the free gas, from observations of its volume, pressure, and temperature. When the original substance and the products of dissociation are all gaseous, the problem becomes exceedingly difficult, and special means must be devised to fit each special case. In the case of nitrogen tetroxide,  $N_2O_4$ , which dissociates into the oxide  $NO_2$ , the degree of dissociation may be inferred optically, since  $N_2O_4$  is nearly colorless, while  $NO_2$  has a pronounced brownish-red color. In other cases, the extent of the dissociation may be inferred from observations of the vapor density of the mixture. This method has been used quite successfully in the case of iodine, the vapor density of this element indicating a molecular formula of  $I_2$  at temperatures below  $700^\circ C.$ , and  $I$  at temperatures above  $1,500^\circ C.$ ; while at intermediate temperatures the vapor is a mixture of  $I$  and  $I_2$ . The dissociation of acetic acid vapor has been studied by the vapor density method, and also by observing the specific heat of the mixture at different temperatures, the specific heat being assumed to be greater (on account of the work done in separating the molecules) as the dissociation proceeds than it is before the dissociation begins, or after it is complete.

Certain compounds (such as sodium chloride) appear to be more or less completely dissociated when they are dissolved in water; but the constituents into which they are resolved possess certain distinctive properties that are not manifested by the resolved parts of substances that are dissociated by the action of heat. For this reason it is now usual to dis-

tinguish this particular phenomenon by a special name, and the dissociation that occurs in such cases is called "ionization." See ELECTROLYSIS; SOLUTION.

**Dissolu'tion**, the resolution of any body into the smallest parts by chemical agency. In English politics, the act of dissolving or putting an end to the existence of a Parliament. It differs from a prorogation, which is the continuance of a Parliament from one session to another, and from an adjournment, which is its continuance from one day to another. A dissolution is the civil death of a Parliament; and this may be effected in three ways: (1) By the will of the sovereign. (2) By the demise of the crown. This dissolution formerly happened immediately upon the death of the reigning sovereign, but it being found inconvenient to call together a new Parliament immediately on the inauguration of the successor, and dangers being apprehended from having no Parliament in being in cases of a disputed succession, it is provided by several statutes that the Parliament in being shall continue for six months after the death of any sovereign, unless sooner prorogued or dissolved by the successor. (3) A Parliament may be dissolved or expire by length of time. As the constitution now stands the Parliament must expire, or die a natural death, at the end of every seventh year, if not sooner dissolved by the royal prerogative.

**Dissolving Views**, paintings upon glass magnified and thrown with great distinctness upon a screen by means of one or two magic lanterns with strong lenses, and illuminated by the oxyhydrogen light. If one lantern is used the picture is drawn out of focus gradually, and a second substituted, which is brought gradually into focus, thus producing the haze and brilliancy which have gained this sort of exhibition its name. If two lanterns are used, they are placed side by side with their lens tubes slightly convergent, so that the images may be superposed on the screen. An opaque rectangular shutter, capable of revolving vertically upon a pivot fixed midway between the lanterns, is placed before the lenses in such a position that, when horizontal, it cuts off one half of the pencil of light from each lens. When this shutter is made to revolve through a small arc, it shuts off the whole of the pencil of light from lantern No. 1, allowing that from No. 2 to pass unhindered. When the shutter is in this position the image from No. 2 falls on the screen in full distinctness; but when the shutter is made to revolve in the opposite direction, the image from No. 1 will be gradually disclosed, as that of No. 2 becomes concealed.

**Dis'sonance** (Lat. *dissonantia* — *dissonare*, to sound harshly). A word in music wrongly supposed by the general public to mean the same as discord (q.v.). Technically, it is a sound of two or more tones struck together which are at variance with the formation of a common major or minor chord. Thus it is an interval, one or both of whose members must move in a certain way to satisfy the ear—demanding resolution into consonance (q.v.). If the dissonance is minor or major one member only is compelled to move. If augmented or diminished both members must move, toward each other if the interval is diminished, and contrary if augmented. All augmented and di-

minished intervals, seconds, sevenths, and ninths are dissonances. Dissonance, however, disregards all limitations, and it is next to impossible to form rules to govern it. In recent years especially, it seems to have become a law unto itself, and appears reaching out for a new science of sound outside of natural harmony. As witnessed in the work of the new school of composers, with such men as Richard Strauss and Edward Elgar for leading exponents, it wields a new and strange power which may revolutionize the tonal world. To demonstrate the progress of dissonance in modern music it is only necessary to cite the very important part the "fifth" plays to-day even in compositions of conservative musicians. Thirty years ago this interval ("fifth") was abhorred by theorists and looked upon as an abomination. See ACOUSTICS; CHORD.

**Dis'taff**, the earliest instrument of spinning, a staff, on one end of which the wool or flax was rolled. The spinner held it in the left hand, and drew out the fibres with the right, at the same time twisting them. A spindle was attached to the thread, the weight of which carried down the thread as it was spun. When the spindle reached the ground the thread which was wound round it was then again fastened near the beginning of the new thread. The 7th of January is called St. Distaff's Day, because it marks the return of the women to their usual household duties, after the revels of Twelfth Day.

**Distem'per**, a disease of the dog commonly considered as of a catarrhal nature. In most cases a running from the nose and eyes is one of the first and chief symptoms. This defluxion becomes after some time mucous and purulent, loading the eyes and obstructing the nostrils; and whenever the animal is subjected to a draught of air, or excitement of any kind, it has violent fits of coughing combined with vomiting, it soon begins to lose appetite, its flesh begins to waste, and it becomes listless and irritable. If the disease be virulent, symptoms of affection of the brain manifest themselves, accompanied by fits, which come on especially at the sight of another dog, or by convulsive twitchings, resembling St. Vitus' dance. In such cases the dog is often supposed to be mad, and frequently destroyed in consequence. Inflammation of the lungs is not an infrequent consequence of the disorder, and the bowels are more or less affected by diarrhœa and dysenteric discharges. Protracted cases are attended by eruptions on the chest and abdomen, and the surface of the body becomes of a yellow hue. These are always fatal symptoms. In the first stage of the disease laxatives, emetics, and occasional bleeding are the principal remedies; diarrhœa should be checked by astringents, and to reduce the violence of the fits warm bathing and antispasmodics should be resorted to.

**Distemper** (from O. Fr. *destemperer*, Mod. Fr. *détrempe*, Ital. *tempera*), in painting, a preparation of opaque color mixed in a watery glue, such as size, white of egg, or glue. It is used now chiefly in scene painting and in paper for walls, but was employed in the higher departments of art before the establishment of oil or varnish painting in the 15th century.

## DISTICH — DISTILLATION

**Distich**, dis'tik, a couplet of verses. No form is more suitable for maxims or sentences than the distich.

**Distillation** is a technical process which results in the separation of a volatile from non- or less volatile components contained in a closed vessel (still, pot or retort), and their conversion, by the application of heat, into vapors, and subsequent condensation to the liquid state. The liquid obtained by distillation is called the distillate, and the remainder is the so-called distillation residue. When water is heated to 100° C. (212° F.), at ordinary atmospheric pressure, it boils and is converted into steam. If this generated steam is conducted through a pipe, around which cold water flows, it will again be transformed to a liquid. In the distillatory apparatus this appliance is called the condenser. The obtained liquid is collected drop by drop in a receiver. The entire process is called distillation, from the Latin word *destillare*, meaning "to drop." Accordingly the essential features in a simple distillatory apparatus are:

1. The still, pot, or retort, that is, the receptacle for the material to be distilled. In accordance with its nature, this material is heated to that temperature at which the products are volatilized.

2. The condenser, by means of which the distillates are condensed.

3. The receiver, which collects the products of distillation in a liquid state.

When distillation is properly conducted, many liquids, as for instance, water, can be purified.

**Distillation of Water.**—Pure water is never found in nature, as it generally contains salts and other mineral substances, organic matter, and decomposition products, partly volatile, and partly non-volatile. The non-volatile components are readily separated by distillation. Inasmuch as the former are mostly very volatile, they are received in the very first distillate of the water, so that it is customary to reject this first portion. Experience has taught that pure water is obtained by distilling three fifths of the entire amount, and rejecting the first one fifth. In some special cases, where a water has many volatile impurities which can be detected by its appearance, odor, and taste, the distillation might be rendered more difficult, as it becomes necessary to add certain chemicals to the water in order to combine the volatile components and to transform them into non-volatile bodies. The purifying of water by means of distillation, or, in other words, the preparation of distilled water, is of much practical value. In the pharmacy, in the chemical laboratory, and in many chemical industries, distilled water is an indispensable article. The transformation of the salt water of the ocean into a potable water, by means of distillation, is also of inestimable value. Pure distilled water, however, has an empyreumatic odor, and a repulsive flat taste. According to the most recent medical investigations, pure distilled water, when constantly used, is, on account of its very purity, deleterious to health. It is claimed that this water possesses high solvent properties and also absterges the mucous membrane of the stomach too much. For this reason, the odor of the water is improved by thorough aëration or carbonization, and it is made potable by the addition of pure

salt or sugar, or any other desired substance. The large ocean steamers have an equipment for producing a potable water from the sea water. The fundamental elements in this apparatus are a steam generator or evaporator, in which the sea water is vaporized by means of superheated steam, which is obtained either from a special boiler or directly from the engine boilers; a condenser combined with an aëerator; and a refrigerator, with which, in many cases, a filter is combined. Special constructions of this style are those of Chaplin, Rocher, Dr. Normandy, Gallé, Mazeline, Perroy, and Hocking, in which simplicity of construction and the economy of coal are the main essentials. In recent times many ships supply themselves with an especially good well water for drinking purposes, while for cooking, washing, and boiler feeding, they distil the sea water as it is required. For these latter purposes carbonating and aërating are of course unnecessary. In most cases the evaporator is directly connected with the ship's engine. The sea water which is to be evaporated is taken from the water cooling the condenser, while the steam is obtained from the steam-jacket, or an intermediate compartment of the engine. In this way, the cylinder is constantly drained and supplied with fresh steam. The most common of these constructions are those of Yarian, Pape & Henneberg, Howe & Beckwith, Pamphlet & Ferguson. The distil constructed by Jones utilizes the escaping gases for heating the water, so that the entire apparatus is situated in the chimney. In general, the distillation of water is very simple, because it is a liquid which has a constant boiling point. More heat in the distillation process simply occasions more rapid evaporation. The departing steam, unless it is heated in a special apparatus, as is done in the case of superheated steam, retains the boiling point temperature until it is cooled.

However, it is different with a mixture of various vaporizable liquids, each of which has a definite boiling point. According to the predominance of one or the other liquid, the mixture will have a varying boiling point. When the vapors passing over at different intervals are separately condensed, it is possible to obtain single components from the mixture, provided, of course, that the various components of the mixture radically differ in their boiling points. This special method of distillation is called fractional distillation.

The best-known distillation process is the separation of water and alcohol, or, in other words, the concentration or rectifying of alcoholic solutions, by means of distillation. This is a special branch of modern industry and is also a valuable source of revenue to the State.

**Distillation of Spirits.**—The boiling points of water and alcohol differ considerably. At normal pressure water boils at 100° C. (212° F.), while alcohol boils at 78.4° C. (173.5° F.). Consequently, it is evident that the boiling point of a mixture of water and alcohol will range between 173.5° F. and 212° F. In proportion to the predominance of alcohol, the boiling point will be lower, and as the alcohol vaporizes, the boiling point will rise until, finally, pure water is distilled at 212° F. If a dilute mixture of water and alcohol [the mash in the American distillery usually contains 5 to 10 per cent alcohol by volume (10 to 20 proof)] is distilled in a simple distilling apparatus consisting of a pot,

## DISTILLATION

or still, and a worm, dilute alcohol is always obtained, and the smaller the quantity of alcohol contained in the mixture, the greater proportionately will be the amount of alcohol contained in the distillate, as is shown in the following table of Groening:

Percentage of alcohol in the boiling mixture		Boiling point		Percentage of alcohol in the vapor	
Volume	= proof	Centigrade	Fahrenheit	Volume	= proof
1	2	98.75	209.7	13	26
3	6	96.25	205.2	36	72
5	10	95.00	203.0	42	84
7	14	93.75	200.7	50	100
10	20	92.50	198.5	55	110
20	40	87.5	189.5	71	142
30	60	85.0	185.0	78	156
40	80	83.75	182.7	82	164
50	100	82.5	180.5	85	170
60	120	81.25	178.2	87	174
70	140	80.00	176.0	89	178
80	160	79.38	175.2	90.5	181
90	180	78.75	173.7	92	184

If the distillate obtained from a dilute mixture of water and alcohol is redistilled, a distillate containing more alcohol is obtained. Thus in four distillations of a mash having 10 per cent alcohol by volume (20 proof), a raw spirit 80 per cent alcohol by volume (160 proof) is obtained, in which the

first distillate contains 28 per cent alcohol by volume,  
= 56 proof.

second distillate contains 50 per cent alcohol by volume,  
= 100 proof.

third distillate contains 70 per cent alcohol by volume  
= 140 proof.

fourth distillate contains 80 per cent alcohol by volume,  
= 160 proof.

Of course, we assume that each time the distillation is carried out completely.

Formerly, it was necessary to repeat the distillation several times, in order to obtain a highly concentrated alcohol. The first weak distillate with less than 20 per cent alcohol by volume was called Lutter. It was used for the further concentration of the alcohol. This method of concentrating alcohol was called doubling or rectification, but as this repetition was tedious and consumed much time and fuel, a shortening of the distillation process was eagerly sought for, and with the aid of suitable appliances it has now become possible to introduce a complex, separatory distillation in one operation.

The following principle is standard for the construction of distillatory apparatus. If the concentrated alcoholic vapors developed at the boiling of the alcohol-water mixture are not cooled directly to the temperature of condensation, but only a few degrees, then a greater part of the less volatile liquid, that is, water, is condensed than of the more volatile alcohol. Through this partial cooling, the remaining vapor accumulates more alcohol. This process is called dephlegmation and denotes a draining of the alcohol, as the older chemists designated the water as a component of spirit by the word "phlegma." Accordingly, the more recent apparatus in larger distilleries, in which highly concentrated alcohols are manufactured, are equipped with a dephlegmation and rectification appliance, in direct connection with the still, so that it has become possible in the column apparatus of to-day, with continual operation, to produce, from the fermented mash, a high

wine free from fusel, containing 90 to 95 per cent alcohol by volume (180-190 proof).

According to the capacity of the plant, and, especially according to the kind of product, various apparatus are used in the distillery; but an enumeration here of these would lead too far,

while their description properly belongs under special heads. Therefore only the main types of various distillatory apparatus are mentioned here:

1. Simple stills, with worm condenser heated by direct firing.

2. Simple stills, with closed washwarmers, in which the mash is previously heated by the latent heat of vaporization.

3. Double pot-stills, generally consisting of two superimposed stills. While the mash in the lower still is being deprived of its alcohol, the mash in the upper still is enriched with alcohol and heated by the vapors of the lower mash, until the latter after sufficient concentration is heated to the boiling point. From this time on alcoholic vapors develop in the upper pot which are cooled in a dephlegmator and absorb still more alcohol. The concentrated vapors pass over into the condenser, while the condensed liquid flows back into the upper still. Such apparatus are either heated by direct firing below the lower still, or by means of steam, which is introduced into the lower still.

4. Two, three, or more chamber charge-stills, with or without charging chamber in one apparatus, in which the single compartments are placed one over the other, and the heat from the lower serves to enrich the one above. Steam is used for heating.

All these apparatus, when heated by direct firing, are made either of copper or iron, when heated with steam are made of copper, but oftentimes made of wood, such as heavy cypress or white oak. These are more suitable for intermittent working, and are mostly used in distilleries which distil rye, whiskey, etc.

5. Continuous pure still apparatus (on account of their form called column apparatus), which are mainly used in larger distilleries, can be regarded as a combination of a larger number of small stills, in which the mash, continuously flowing from the upper compartments to the lower, constantly comes in contact with steam flowing in the opposite direction. Through this countercurrent, the rising vapors become more rich in alcohol, through the dephlegmation and rectification taking place in each of the compartments, while the mash flowing downward is constantly deprived of its alcohol until it flows from the lowest chamber as slop, free

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from alcohol. The concentrated alcoholic vapors, escaping from the uppermost chamber of the column, are then liquefied in a condenser when alcohols of only moderate strength (125 to 150 proof) are to be produced; but, if very pure highly concentrated alcohols are to be manufactured, these vapors pass over into a similarly constructed rectification column, where they meet with the liquids (lutter or phlegma), returning from the dephlegmator or condenser. The vapors take up alcohol from the liquids and pass from the upper chamber of the rectifier into the dephlegmator, in which a continual countercurrent between the condensed liquids constantly takes place.

These continual apparatus are improvements of the apparatus of Coffey, which are much used in England and Scotland; Savalle, an improvement of which is used in France; of Pistorius, Ilges, Siemens, Bohm, and others. The advantages of the continual column apparatus in comparison with the simple pot-stills, are, that the mash is more quickly vaporized, that the expense for fuel is diminished and that, as a rule, a more highly concentrated product is obtained. But, on the other hand, they also require more care and attention and skilled operators. They are also more difficult to construct (therefore it is advisable to place an order with a first-class reliable firm). Besides there is a possibility that alcohol might sometimes pass off with the slop. In the simple stills this possibility is considerably reduced, so that it is still advisable for small distilleries to erect good pot-stills, because they mostly manufacture alcoholic liquors with about 50 per cent alcohol by volume (100 proof).

The alcoholic liquid obtained in the distillery with the best modern apparatus contains, besides the highly concentrated alcohol (96 per cent by volume, 192 proof), more or less fusel oil, by which the admixture of various substances besides water is meant. Up to the present time, the following impurities contained in 50 to 95 per cent alcohol by volume have been determined; acetic aldehyde, propylic alcohol, isopropylic alcohol, butylic alcohol, acetic ether, butylic ether, acetal, secondary amyl alcohol, isoamyl alcohol, isobutyl alcohol, furfural, and various amines. In the corn and potato spirits amyl alcohol is in predominance, and therefore it is briefly called fusel oil. Technically, fusel oil is not a uniform substance, but the higher boiling part of the impurities accompanying the alcohol distillation.

Very little is known about the origin of these substances. Their presence might be due to secondary fermentations which are produced by fission fungi, schizomycetes, but the yeast itself may also have a certain influence, as certain yeast species are capable of producing fermentation products of a definite aroma and taste. For example: *Saccharomyces ellipsoideus* produces a peculiar fruit bouquet. It is well known that aging or decaying yeast furnishes a more impure product than a sound and vigorous yeast. The raw material used in the distillery must also be considered. The corn, rye, and potato fusel oil differ in composition, so that through experience one is enabled to detect the materials used, by the odor of the raw spirit. The fusel oil of the rye spirit contains, besides amyl alcohol, aromatic onanthic ether; the molasses spirit contains the ethers of caproic acid, capric

acid, caprylic acid, etc., which are very similar to the so-called oil of wine. Finally, the construction of the distillatory apparatus also influences the quality of the product. High pressure and too long a sojourn of the alcoholic vapors in the rectifier or dephlegmator are also said to be detrimental.

As it is necessary for some industries to use pure alcohol, these impurities are generally removed by either of two processes: (1) Filtration of the raw spirit through charcoal; (2) refining, by fractional distillation, or, in some cases, a combination of both.

In the manufacture of brandies, the former method is generally and successfully used, as a trace of impurity gives the brandy its characteristic aroma and taste. Finely powdered charcoal made from soft wood or bark served as the filtering medium. It is well known that charcoal, by virtue of its absorbing capacity, serves as a decolorizer and deodorant, and in order to effect thorough absorption, the spirit must be diluted to about 40 per cent by volume (80 proof). In smaller plants the filter consists of a vat packed with charcoal. The larger distilleries and refineries use a battery of iron cylinders packed with granular or powdered charcoal. Steam is conducted into the battery until the charcoal is thoroughly saturated; then the spirits flow in, displacing the steam and filling the pores of the charcoal. The larger part of the impurities is absorbed in the lower cylinder, while the remaining impurities are removed during the passage through the remaining cylinders. If a filter is ineffective, it is cut out, the spirit is drawn off, steam is introduced, which forces the distillate into the condenser. This distillate constitutes the so-called "feints." The feints is a dilute spirit, which is milky in appearance on account of the presence of fusel oil. After standing, the fusel separates and can then be utilized, while the alcoholic liquid is worked up anew. The emptied filtering cylinder is repacked with charcoal and used as the last filter. The used charcoal is either ignited in a special furnace, or else purified by means of superheated steam.

*Refining of Spirits.*—In order to produce an entirely fusel-free and highly concentrated alcohol, which is used for blending wine, cognac, etc., as well as for scientific and certain technical purposes, the filtered alcohol must undergo a fractional distillation. It is essential that the alcohol, whether filtered or not, be diluted to about 40 to 50 per cent by volume (50 to 100 proof).

The rectifier for refining in general is the same as the distilling apparatus, but, inasmuch as the operation is a fractional one, it is an intermittent one. The columns are equipped with caps, bells, or sieves.

Through distillation we receive:

1. The first runnings or fore-shot. This is the first distillate which contains those impurities of the alcohol which vaporize below the boiling point of the latter. Among these impurities acetic aldehyde is especially predominant.

2. Rectified fine spirit, which is divided into several distinct products, of which the first still contains some substances vaporizable at a low temperature, and the intermediate products are pure alcohol, while the last portions already contain substances which volatilize at temperatures above the boiling point of alcohol. All



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of these products are separately collected at different intervals and furnish:

(a) Wine spirit, commercially known as Cologne spirit. It contains 96 per cent of alcohol by volume (192 proof).

(b) Prime spirit, which is technically absolute alcohol. For medicinal purposes it meets the requirements of the alcohol deodoratum of the United States Pharmacopœia. It contains 94 to 95 per cent alcohol by volume (188 to 190 proof).

(c) Common spirit or high wine, commercially called "rectified spirit." It is used for blending wine and cognac, for medicinal and all other purposes when a pure, fusel-free, less concentrated alcohol than the foregoing is necessary. It contains about 90 per cent by volume (180 proof).

(d) Alcohol of about 88 per cent by volume (176 proof), which can be used for blending brandies as well as for preparing dilute alcohol (97 to 100 proof).

(e) Weaker alcohols, which are usually re-distilled with the raw spirit.

(f) The so-called last runnings or feints, which usually contain amylic alcohol, are used in various industries, as for example, in the textile industries, on account of their solvent power over fats and oils; in the manufacture of ethereal oil and also in the chemical laboratory.

By means of filtration and fractional distillation, about 85 to 90 per cent of the raw spirit are obtained as rectified spirit, therefore it has been the object of many experiments to improve this yield.

The attempt was made to remove the fusel, by using, in place of charcoal, either soap, oil, or fatty substances. It was believed that these substances would retain the fusel. Besides these, chemical agents as soda, lime, sulphuric acid, acetic acid, nitric acid, chloride of lime (bleaching powder), the peroxides of hydrogen, lead, manganese, etc., which were to destroy the fusel, were used. Most of these agents either act only upon certain components of the fusel, while the higher alcohols remain unchanged, or else the ethyl-alcohol was more energetically attacked than the impurities.

According to "Eisenmann's patent," the fusel could be removed by means of ozonated air, but no more practical results were achieved by this process than by that patented by Bang & Rufin. At one time this latter method received much attention, as it was claimed that if the raw spirit was treated with kerosene, it would give off all its impurities to the latter.

The only successful defuselizing process is that of Traube, by which a sufficiently concentrated potash solution is mixed with the spirit in accordance with its strength, and heated to 60 to 70° C. (140 to 148° F.). Two layers are formed, the upper, which is dark-colored and foul-smelling, contains the impurities, and in the lower we find the purified alcohol with the salt solution. After removing the former, the latter is distilled in a rectifier and concentrated; 97 to 98 per cent of the raw spirit are secured by this process.

But after all, filtration through charcoal is the best practical refining process for brandies, while filtration and fractional distillation are best employed for Cologne spirits. In large distilleries the manufacture of Cologne spirit and rectified alcohol directly from the mash

is both practically and technically the most advantageous when manufactured in apparatus based on Ilges' system. American copper-smiths manufacture an excellently constructed apparatus of this type. In ordinary distillation and refining, a deterioration of the material takes place, as the fermentation products of the normal mash are purer than those of the raw spirit. The presence of atmospheric air in the condenser induces the formation of aldehydes, and, in the raw spirit, foul-smelling substances. By means of slow evaporation in the rectifier fusel oil is decomposed, while in the new automatic spirit apparatus, it is obtained as fusel oil. These apparatus are equipped with very effective dephlegmators and rectifiers, so that it is an easy matter to precipitate the fusel from the alcoholic vapors and to receive only the purest alcoholic vapor in the condenser. In order to prevent an accumulation of fusel in the ever-returning phlegma temperature regulators and fusel separators are attached in the latter, so that the phlegma constantly has a uniform temperature and fusel can never be in excess. The advantages of this process are not only the dispensing with rectification and filtration, but also the production of a pure valuable spirit of about 95 per cent alcohol by volume (190 proof), while the valuable and untaxed fusel is obtained as a by-product. In addition, the yield is greater, as the loss caused by rectification is avoided.

Absolute anhydrous pure alcohol cannot be made in this way, nor can it be prepared by repeated distillation, as alcohol is in itself hygroscopic and tenaciously holds on to the last traces (3 to 4 per cent) of water. This last remnant of water can only be removed by very effective dehydrating agents; as for example, freshly burned lime, anhydrous carbonate of potash, anhydrous white copper sulphate, fused calcium chloride, and especially metallic sodium. By distillation over any of these substances the water is absorbed and an absolutely anhydrous pure alcohol is produced. This process is, however, only carried out in chemical laboratories, and as a precautionary measure this alcohol is stored in small bottles with any of the above substances. This precaution is taken in order to prevent the absorption of moisture by the alcohol.

The distillation of alcohol, as in many other distillatory operations, is merely a mechanical process of purification, as no chemical change takes place, because the distillates have the same chemical composition as the original substance. Distillation is only a mechanical separation of the secondary ingredients from the principal one. Some substances, as for instance, glycerine, when distilled in presence of atmospheric air, will decompose. In such cases the distillation is done in a partial vacuum. By means of an air-pump air is withdrawn, until the boiling point is lowered to that degree at which the distillation can take place without decomposition. It is well known that matter will boil at a lower temperature, when the pressure is decreased; and that decomposition is less liable to occur. Again, other substances cannot be distilled in the presence of much oxygen, so that carbonic acid, hydrogen, or other gases are forced into the still. These gases pass over with the vapors of distillation. This process is called the distillation in an atmosphere of an indifferent gas.



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Another important distillation is the so-called dry distillation, in which organic substances are decomposed into solid, fluid, and gaseous products by means of high temperatures and with the exclusion of air. As a rule these products, called empyreumatical, are formed simultaneously, but are separately collected and treated. An example of dry distillation, which is also called destructive distillation, as it is accompanied by chemical changes, is the distillation of coal for the manufacture of illuminating gas, ammonia-water (in the raw condition, tar-water, which contains cyanides and sulphocyanides in connection with ammonia), semi-fluid, viscous, oily, and very valuable products, as, for example, tar-oil, which is extensively used in the manufacture of aniline colors, antiseptics, and medicinal preparations, are obtained as by-products, while coke is the residue of the coal distillation.

Besides these above-mentioned industries, many others are also based on the distillatory process. Among these are the distillation of wood by which acetic acid, wood alcohol, and wood tar are obtained; the distillation of resins through which turpentine, resin-oils, colophony are obtained; the petroleum industry and many others.

A special branch of distillation is that in which a solid is vaporized and by condensation directly passes from the gaseous to the original solid usually in a crystalline form. This process is called sublimation, and is mostly used to purify volatile solids, as for example, sal-ammonia (chloride of ammonia), benzoic acid, camphor, and indigo. The most interesting part in sublimation is that the solid does not pass through a liquid state, but at once to the gaseous form. The reverse process also takes place in like manner, namely, the condensation from the gaseous state back to the solid condition.

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**Distilled Liquors**, all the liquids obtained by distillation. It is often customary to consider, in contradistinction to the fermented liquors, wine, beer, cider, vinegar, only those distilled alcoholic liquids which contain about 30 to 50 per cent alcohol by volume (60 to 100 proof), and are consumed as alcoholic beverages or distilled liquors (whiskey, brandy, cognac, rum, arrack, gin, etc.). All the other more highly concentrated alcoholic liquids used in technics, medicine, pharmacy, etc., are called alcoholic spirits. In the distilled liquor beverage, alcohol is always the main ingredient, and the varying aroma and taste, due to the origin and the method of procedure, influence its commercial value. On the other hand, spirits are judged according to their concentration, so that secondary ingredients and aromatic substances deteriorate their value. Hence in the manufacture of spirits everything that is not alcohol is eliminated.

In the United States the concentration of alcohol is determined according to proof-degrees. The regulations of the United States Internal Revenue Office say that "proof spirit shall be held to be that alcoholic liquor which contains one half its volume of alcohol of a specific gravity of 0.7939 at 60° F." Therefore each proof-degree is equivalent to 0.5 volume per cent.

If 100 gallons of liquor contain 48 gallons of absolute, pure alcohol, it is 2 x 48 or 96 proof, and a spirit containing 92 gallons of alcohol per 100 gallons, is one with 92 x 2 or 184 proof. The revenue standard is a liquor with 50 volume per cent (100 proof) of alcohol. "Over" and "under" proof are not officially recognized in the United States, although we find these distinctions given in older books.

The raw materials used in the preparation of alcoholic liquors and spirits are:

1. *Alcoholic liquids*, as wine and its waste and by-products (wine-yeast, grape-cakes), the waste and by-products of the brewing industry, in which the spirit is obtained solely by distillation. The product of the wine distillation is used almost exclusively for cognac and brandy, which are especially manufactured in California and Ohio.

2. *Sugary substances*, as the extracts of the sugar-beet, sugarcane, mainly molasses, and also of sweet fruits (cherries, plums, sweet potato, Jerusalem artichoke, melons, etc.). The sugar must be converted into alcohol prior to distillation.

3. *Starchy substances*, among which we can enumerate the various cereals (barley, barley-malt, corn, rye, wheat, oats, rice, buckwheat, etc.), and also potatoes. Corn, barley, barley-malt, rye, oats, and wheat are mostly used in the United States. Before the alcohol can be obtained, the starch must be transformed into fermentable sugar, which in turn is fermented, previous to distillation.

4. *Fibrous substances*, in which the cellulose is converted into fermentable sugar. The further treatment is the same as above (No. 3). Concentrated mineral acids acting under pressure on cellulose, will cause the formation of fermentable sugar, and since such fibrous substances (peat, sawdust, etc.) are inexpensive, many experiments have been made to obtain a practical method for producing alcohol from such materials. Many such methods have been patented. During the International Chemists' Congress at Berlin, 2-8 June 1903, Simonson, from Christiania, Norway, reported on a process of manufacturing spirit from sawdust and also presented a calculation of the prospective profits, which, however, still lacks the confirmation of actual trial. The manufacture of alcohol from fibre stuff is as yet of theoretical interest, and is therefore merely mentioned here. Likewise is the preparation of

5. *Mineral spirit* of theoretical interest, although it can be prepared in the chemical laboratory. If ethylene ( $C_2H_4$ ) is conducted into sulphuric acid, ethylsulphuric acid ( $C_2H_5HSO_4$ ) is formed, which if diluted with water will split up into sulphuric acid and alcohol. Ethylene is a gas and is an ingredient of illuminating gas made from coal. It is also easily produced from acetylene ( $C_2H_2$ ) by nascent hydrogen, according to the formula  $C_2H_2 + H_2 = C_2H_4$ . Acetylene is cheap, and is most readily obtained by the action of water upon calcium carbide ( $CaC_2$ ). It is extensively manufactured and copiously used, but undoubtedly these experiments will be perfected in the future.

In accordance with the importance of these various kinds of raw material consumed in the large United States distilleries, we will first

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of all discuss the manufactures of liquors and spirits from starchy substances.

These raw materials are treated, as in the brewing industry, with malt (mostly barley malt, sometimes also rye and wheat malt) in such a way that the diastase of the malt converts the starch into dextrin and sugar. But a distiller's malt differs in its properties from a brewer's malt. While the latter must impart its aroma and taste to the beer and only exert its diastatic power in a moderate degree, the former must be characterized by a maximum of diastatic power. Consequently the distiller prefers a malt from a small-kerneled barley, which has been kilned at low temperatures. The diastatic power is weakened by high temperatures. Consequently some distillers, who operate a malting plant in connection with their distillery, use only green malt, or at most, air-dried malt. The German distillers universally use green malt. In contradistinction to the brewer, the distiller prefers a malt made from a barley rich in nitrogenous matter, as this latter furnishes material for the formation of diastase and for the nourishment of the yeast. It is entirely wrong to suppose that a good brewer's malt is also a good malt for distillers. In mashing, the largest possible amount of starch must be converted into fermentable sugar (maltose) in order to obtain as high a yield of alcohol in the distillation as possible. Under the most favorable conditions 96 per cent of the starch in the mash material can be converted into maltose (the remaining 4 per cent are changed into dextrin), while in practice only about 80 to 81 per cent maltose are obtained, and the remainder is dextrin. After the maltose is decomposed into carbonic acid and alcohol, the dextrin is gradually converted by the diastase into maltose and then fermented. This can only be accomplished with vigorous yeast and proper treatment in the fermenting rooms. On account of this "after-effect" the diastase must be carefully guarded, especially by avoiding high mashing-off temperatures, and the formation of lactic acid and particularly butyric acid, produced by certain bacteria at a temperature of 40 to 50° C. (104 to 122° F.).

The mashing process varies according to the kind of product desired, the capacity of equipment (large, or small, or very small, the latter requiring hand power for mashing in place of machinery), the amount and quality of the raw material, and, oftentimes, on the fancy of the customers. Inasmuch as whiskey is the main product of United States distilleries, we will discuss its preparation first of all.

The word "whiskey" is of Celtic origin, for it apparently is an abbreviation of the word "usquebaugh" or "uisgebeatha," which corresponds to the Latin *aqua vitæ* (water of life). According to historical research the word *aqua vitæ* is a corruption, because the original wording for distilled spirit was *aqua de vite* (water from the grape vine). In mediæval times the monks changed this latter form to the one now in general use.

Although the same word is used in America, Ireland, and Scotland, the product is very different. The Irish and Scotch distilleries use almost exclusively kilned malt (only rarely, other cereals), while the American distilleries have an entirely different equipment and also their own characteristic development.

For the manufacture of whiskey, especially corn and rye, sometimes also bran, wheat, and kilned malt (6 to 15 per cent) are used. The best-known brands are:

*Bourbon whiskey*, in the manufacture of which corn is the main ingredient. According to the quality of the Bourbon, the materials vary as follows:

BRAND	Malt	Rye	Corn
	Per cent	Per cent	Per cent
Ordinary Bourbons.....	10	10	80
Medium Bourbons.....	12	18-22	66-70
Good Bourbons.....	15	35	50

*Rye whiskey* when manufactured as a first-class article is made from 10 to 15 per cent kilned malt, 70 per cent rye, and the remainder rye-malt. Some distilleries replace a part of the rye by oats or barley.

*Half rye whiskey* similarly made as the above, except that for one half of the rye, corn is substituted.

*Malt whiskey*, in which malt predominates.

*Wheat whiskey* and

*Oat whiskey* are made in the same way as rye and half rye whiskey, except that wheat or oats is used in place of rye.

We must remark here, that the above appellations are only correct for the distiller, and that in commerce similar names are given to so-called compound whiskeys. Under this term are meant those products which are obtained from pure whiskey, either by dilution with water and rectified spirits, or by a mixture of several kinds, or by still further blending and mixing. In some cases, other liquors, as, for example, cognac, or rum, or even essences, are added to the pure whiskeys. This compounding is done in accordance with the requirements of local trade, or the special tastes and desires of the customers. The character of the natural product is dependent upon the materials and the methods of mashing and distilling. It is interesting to note that the taste of the public varies as the years pass by. In the United States during the fiscal year 1892-3, 40,835,783 gallons of Bourbon whiskey and 16,702,336 gallons of rye whiskey were made, while in the fiscal year just closed, the production of Bourbon whiskey was only 20,336,250 gallons, while that of rye whiskey was 21,587,221 gallons.

According to the mashing method we distinguish a "sweet mash" and a "sour mash" whiskey. The latter is characterized by a delicate, slightly sour taste and a fine ethereal aroma.

*Mashing for Whiskey.*—The material is ground separately, weighed in hoppers, and placed under a revenue-lock. In the smaller distilleries the corn is cooked with hot water, and kept boiling by means of steam until the starch is gelatinized. In larger distilleries the corn is gelatinized in high pressure cookers, under a pressure of 60 to 80 pounds. In either case the cooked corn is cooled down to about 164 to 166° F. In the high pressure cookers this reduction in the temperature is accomplished by a vacuum pump. In the smaller plants, malt, rye, or other cereals are added to the corn mash cooled to 164 to 166° F., so that the entire mash has a temperature of about 156 to 160° F. In the larger distilleries the specially prepared rye or malt mash is drawn into the

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cooker by means of a vacuum pump. Here it is thoroughly mixed so that the final temperature is about 154 to 156° F. In order to obtain complete saccharification, mashing is done at this temperature for about 20 minutes, then the mash together with the grains are run into a collecting tub, from which it is pumped through a cooling system into the fermenters. The cooling system usually consists of a worm of a half inch copper pipe, which is encased in an iron water pipe. The mash flows through the copper pipe in one direction, while the current of water flows around the pipe in the opposite direction. It is always desirable to cool the mash to 64° F., but on account of the higher temperature of the cooling water, it is usually possible to cool the mash only to 66 to 68° F. At any rate its temperature should never be above 70° F. The concentration of the mash varies proportionately with the amount of material, and is usually about 18 to 25 per cent (seldom more), according to Balling.

While the mash is pumped into the fermenters, as much water or slop of the same temperature as the mash is added to the latter until its concentration is about 11 to 13 per cent, according to Balling.

The above-described method is used for sweet mash whiskey, while for sour mash slop is always used for mashing in place of water. The slop has not only acquired a definite acidity through the fermentation process, and certain peculiar and flavoring substances from the yeast, but also has obtained certain conversion products, formed by heating the grains in the distiller. Hence by the use of this slop, the whiskey receives those characteristics which have made it popular. In smaller distilleries, oak vats, so-called bushel tubs are used, into which boiling slop is poured, and corn in grits-form is doughed in under constant agitation with the hand (hence the name, hand-made sour mash). The malt and rye are added at 165° F. In medium-sized plants a large quantity of corn is doughed in in a similar manner in special mash tuns, and after the mash becomes somewhat thinner, due to the saccharification, it is pumped into hopper-like copper vessels. After the mashing off, the mash remains in the bushel tubs of the smaller distillery or in the vats of the larger plants for 20 to 24 hours for acidification. After this time, the mash is still of a somewhat solid consistency, so that it is separated in drums by means of a disintegrator. After cooling to the pitching temperature (64 to 68° F.), the mash is diluted with slop, to about 17 to 19 per cent, according to Balling. In some distilleries the concentration is lower.

The mashing process is different in very large distilleries, which have commodious mechanical appliances, and are prepared to mash vast amounts of material. It is customary to bring the corn mashed with water, to the boiling point by means of steam, and then to heat the corn to 300 to 370° F. (60 to 80 pounds pressure). The corn is kept at this temperature for 10 minutes in order to gelatinize the starch. The surplus steam is blown off, and the corn mash is cooled to about 164° F. At the same time, malt, rye, oats, or barley is mashed in with water in a special mash tank, which is supplied with a simple agitator and a double copper attenuator coil. After both mashes are united, the temperature is about 140 to 142° F.,

which is the temperature at which the largest possible amount of sugar is formed.

This mashing method is used in the large factories both for the manufacture of whiskeys, high wines, and spirits. The various brands of whiskey are then made by the use of different materials in varying properties. These large distilleries also use slop in place of water when making a sour mash whiskey. In order to obtain a higher degree of acidification, more lactic acid is allowed to form in the malt mash. In comparing the large distilleries with the smaller ones, we find that while the latter can pay more attention to the characteristic properties of the whiskeys, especially sour mash and fancy goods, the former does its practical work more technically and also obtains much higher yields. The manufacture of concentrated alcoholic spirits is only profitable when all the modern mechanical appliances are at hand, so that, owing to the constant decrease in the price of alcoholic spirits, the number of smaller plants is becoming less.

*Fermentation of the Mash.*—The sugary mash is fermented in the fermenters by means of yeast. In England, common ale yeast is usually added; in France and Belgium either top-fermenting or compressed yeast, which is also used by bakers, is generally added. In the scientifically operated German distilleries, the inventions and discoveries of modern times are successfully used, as for instance, a pure yeast culture of a distiller's yeast is made according to Hansen's method, just as a pure beer yeast is cultivated in many United States breweries according to the same method. (For a description of this process see under BREWING and YEAST and YEAST CULTURE.) In the United States distilleries a yeast obtained by spontaneous fermentation is generally used. Here Delbrueck's teachings in regard to natural pure culture are of importance. Experience teaches that when several yeast species are present, a certain one can be developed under certain conditions of nourishment, because a mash of definite concentration and proportion of fermentable to non-fermentable substances, made from definite materials, consequently containing definite percentages of albuminous and mineral substances, will vigorously develop at a definite temperature and acidity only one species of yeast and will suppress the rest. By maintaining the same conditions on a larger scale, that is, by using a greater amount of mash, the yeast thus developed can be further propagated. But in spite of the utmost care, natural pure culture is oftentimes defective, because the standard requirements are not rigorously observed. It may also happen that among the air yeasts which are developed for spontaneous fermentation, there is no species which will flourish under these requirements. Consequently, it would be advisable also to introduce in this country pure cultures, made from one individual cell, according to Hansen's method. Then the distiller would not be dependent on chance; and, of course, a pure yeast developed according to Hansen's method, would have to be cared for according to the principles of natural pure culture, as, otherwise, an infection with undesirable yeasts, mycoderma or fission fungi would gradually destroy the pure yeast.

In the United States distilleries the yeast is developed as follows:

A clear malt mash is made from ground

## DISTILLED LIQUORS

malt and pure water, generally condensed water. The water is boiled with hops, 1 oz. of hops per gallon of water, cooled to 170° F. and added to the ground malt, whereupon saccharification will take place. As soon as the conversion is completed, a clear mash is drawn either by filtration or extraction, which is then concentrated to 18 to 30 per cent according to Balling and cooled to 70° to 72° F. Air is forced into the mash in small copper vessels, so that after 24 to 48 hours the yeasts of the air will cause fermentation. This mash in the copper jugs is the so-called stock-yeast and is cultivated as needed. In case the yeast thus obtained is not satisfactory, the process is repeated. Most distillers constantly have a supply of this jug-yeast on hand and regenerate it by adding a portion of it to the above described, hopped, clear malt mash. This original yeast is poured into sterilized copper jugs and stored in an ice box or other suitably cool place.

This yeast is propagated for use in this way: Rye and malt are saccharified in water of 148 to 150° F. Acidification takes place during 24 hours, during which a temperature of 150° F. is maintained by means of a copper coil attenuator. After this period cold water is run through the attenuator, and the mash, having 18 to 20 per cent (Balling), is cooled to 66° F. and pitched with jug-yeast. After 12 hours this mash has sufficiently fermented, so that it can be used in pitching the large mashes.

The pitching temperature of the principal whiskey or spirit mash is usually 66 to 68° F. and in many cases of defective cooling is somewhat higher. The yeast mash is allowed to run to the main mash. The fermentation usually commences rapidly and shows an increase in temperature. After 24 hours the fermentation is most vigorous. The duration of fermentation is sometimes only 48 hours, for spirits and sweet mash whiskeys it is 72 hours, while for sour mash whiskey it requires 76 hours.

Sometimes abnormal conditions arise, among which is the so-called "foaming fermentation" that is an exceptionally stormy fermentation, in which losses of alcohol occur, due to the flowing over of the mash over the edge or rim of the fermenter. This is a result of various defects, and is either partly due to the materials, or the yeast, or may be occasioned by irregularities in the operation, or even by other causes. It would lead too far to enumerate them here, but much has been written on this subject by experts.

The fermented mash, called the sour mash, is now pumped into the distilling apparatus, where it is distilled as is fully described in the article DISTILLATION. It is customary to distil the whiskeys to 102-105 proof and spirits to 125-190 proof. In small distilleries an ordinary potstill is used for whiskeys and a liquor of about 70 proof is obtained, which is concentrated to 101-102 proof in a doubler. A doubler consists of a copper cylinder having a wide outlet pipe, from which the vapors enter the condenser. In the small distilleries, the heating is accomplished

by direct firing, by which a peculiar, characteristic taste, which is appreciated by the consumers, is engendered. Such whiskey is called "Fire Copper Bourbon Whiskey."

When oats, barley, or wheat are used in the manufacture of certain whiskeys, they are worked up in the same manner as rye in the above-described mash.

Potatoes are not mashed in the United States, although they are commonly used in Germany. They contain only 18 to 20 per cent of starch, while the cereals contain 60 and more per cent of starch. Instead of mashing the ground, rasped or chipped potatoes in open mash-tubs, as was formerly done and is even done to-day in small plants, they are now first steamed under a pressure of 2 to 3 atmospheres, whereby the starch is put in condition to be easily acted upon by the diastase. After the steaming the potato mass is cooled to 55 to 60° C. (131 to 140° F.), which is the best saccharification temperature. Then this mass is mixed with malt, generally green malt, either in the cooker or in the mash-tub, and saccharified. It is customary in Germany to make a thick mash of 22 per cent (Balling), sometimes even of 26 to 28 per cent. The fermentation is accomplished by the addition of a cultivated pure culture yeast. The distilling process is similar to our method. In Germany less brandy but more highly concentrated alcohol for industrial purposes is made.

A special liquor obtained from starchy substances is arrack, which is made in the East Indies, partly from rice and partly from the juice of the cocoa-trees, called toddy, from which "Arrack de Goa" is distilled. The rice is germinated and treated about the same as barley malt. Good arrack is said to be made from 30 to 35 per cent rice, 3 to 5 per cent toddy, 60 to 65 per cent molasses from the sugarcane.

In all those cases, in which a mealy substance is utilized, the thin slop remains after the distillation, which contains all the ingredients of the corn and yeast mash. Besides the skins and husks, we find albumen, unfermented sugar, lactic acid, acetic acid, glycerine, mineral substances, etc. This wet slop was mainly used as feed for cattle, so that formerly every distiller also had a herd of cattle. It is claimed that an animal's health will suffer if slops are copiously fed, so that on this account, and especially in order to dispense with some of the labor caused by the maintenance of the cattle, the slop was dried. By thorough drying, which can be done immediately after the distillation, spoiling is prevented and a constantly durable and valuable article of commerce, which need never be given away below its full value, is obtained. The drying of slop is accomplished in several operations: (1) Settling of the insoluble substances; (2) Pressing out; (3) Drying in cylindrical driers.

There are also some apparatus in which the slop is concentrated by means of steam, pressed and finally dried.

The feeding value of wet and dry slop can readily be seen from these analytical data, ob-

ANALYSIS OF THE SLOP.

Condition	Water	Proteids	Nitrogen-free carbohydrates	Fat	Cellulose	Ash
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Wet .....	91.2	2.34	3.63	1.22	0.88	0.74
Dry .....	11.94	23.43	36.35	12.22	8.78	7.28

## DISTILLED LIQUORS

tained by the Industrial Chemical Institute of Milwaukee in an analysis of slop in either condition. The mash material was composed of 80 per cent corn, 10 per cent rye, and 10 per cent malt.

*Preparation of Alcohol from Koji, according to Takamine's patent.*—This process, which is used in Japan in the manufacture of saké, was changed for other cereals by Takamine, a Japanese, and was introduced by him in 1893-4 in the Manhattan Distillery in Peoria, Ill. But this process has not been extensively used, so that now, after 10 years, it is almost forgotten, although it aroused considerable interest at one time. In this process the spores of a certain fungus, as for instance *aspergillus oryzae* are exposed in hothouse-like compartments to uniformly moist air of 77° F. on steamed, coarse wheat bran. The spores rapidly develop to an exuberant white mold whose mycelium forms numerous spore-bearing threads which grow into the nutrient medium. A considerable portion of the nutrient medium is consumed and a decided rise in temperature is noticeable. According to the temperature, the formation of mold is finished in about 36 to 48 hours, whereupon the mass with the fungi is mixed with an equal amount of wheat bran and extracted in water, whereby the Koji-extract is obtained. This is added at 140° F. to corn, cooked in the customary manner, whereupon complete conversion is effected as with diastase. The mash thus obtained, which has a concentration of about 15 per cent according to Balling, is fermented in four days by means of a fungus, called takamato, propagated in a similar manner to the Koji fungus. It is claimed that the yield in this process is 11 to 12 per cent higher than in the process now in vogue, so that it is really surprising that this process is not adopted.

In the Belgian distilleries Effront's system is successfully used to prevent disturbances in the operation of the plant caused by infection. The main principle in this system is that the highly antiseptic hydrofluoric acid or mono- or bifluoride of ammonia is added to the mash, through which the formation of lactic acid becomes unnecessary; the work is also much more accurate. Yet this process has not yet been introduced in the United States.

*The Control of the Distillery.*—It is self-evident that the control in the distillery is of prime importance in a rationally operated plant, for which reason also, the large distilleries which have well-equipped laboratories, work advantageously, while on the other hand, the small distillers constantly suffer large losses. The control is properly carried out when regular analyses are made of the raw materials of the supplementary articles, namely the yeast, the mash before and after fermentation, the slop, the water and also the air in the mashing and fermentation cellar. (The Kentucky distilleries use a pure, hard water, rich in lime.) It happens in too many cases that the control is not properly carried out, which is, of course, a loss to the distiller, although at present the small distiller is enabled to have the control carried out by a special laboratory (Industrial Chemical Institute of Milwaukee). When the control is properly exercised, the yield will be increased. Inasmuch as theoretically one pound of starch produces 0.5678 lb. of alcohol, then, according to Hantke, the highest possible yield of a distiller's bushel

(which is always figured at 56 lbs. whether the material actually weighs that much or not) with

- 60 per cent starch in the material will be 5.76 gal. Proof alcohol.
- 61 per cent starch in the material will be 5.86 gal. Proof alcohol.
- 62 per cent starch in the material will be 5.95 gal. Proof alcohol.
- 63 per cent starch in the material will be 6.05 gal. Proof alcohol.

But actually the following yields are obtained from one bushel of grain (56 lbs.):

- 90 per cent corn + 10 per cent malt, about 4.7 gal. Proof.
- 55 per cent corn + 35 per cent rye + 10 per cent malt, about 4.25 gal. Proof.
- 65 per cent rye + 15 per cent malt + 20 per cent of rye malt or oats, or barley—about 4.0 gal. Proof.

Among the sugary materials used in distilling, the molasses, both of the beet and cane sugar refinery, is used, and the production of liquor from molasses is continually increasing. Molasses contains about 70 to 80 per cent extract, of which about 50 per cent is sugar. On account of its concentration the molasses must be diluted and because of its alkalinity it must be neutralized. Hydrochloric acid is generally used for the neutralization. Molasses thus prepared is pitched with yeast and fermented just like a sweet mash, but in many cases it is difficult to ferment the molasses, probably because of the presence of butyric and other fatty acids, which are largely present and are known to retard and stop fermentation. Also very abnormal and undesirable fermentation phenomena, as, for instance, saltpetre fermentation, can be traced to the characteristic properties of the molasses. Lately a liquor is obtained from molasses in the United States which acquires a definite aroma and taste, according to character of yeast mash, so that it resembles certain standard brands, such as Bourbon, etc.

In the West Indies, especially in Jamaica, the molasses of the sugarcane, which is merely extracted to obtain the sugar, so that the molasses contains no admixtures as it does in our sugar refineries, is fermented and distilled. This product is called rum, in which the peculiar aroma is due to butyric ether. An inferior grade of rum is made from the sugar scum. Many brands of rum acquire their bouquet through the addition of clover leaves, Botany-bark, etc. Artificial rum, made by mixing spirit with rum essence and adding a little coloring matter, can readily be distinguished from genuine rum.

Sweet fruits, the juice of which is rich in sugar, also serve as raw materials for the spirit industry. The so-called Kirschwasser is obtained from cherries. Besides the juice, the extract also contains components of the cherry stones, which are crushed and added to the liquid.

Sliwowitz is obtained from prunes, and in like manner a liquor is obtained from peaches (peach brandy). In the East Indies a liquor is distilled from the fermented juice of the date palm, while in the West Indies the same is done with the fermented juice of the plantain. Pineapples, oranges, apricots and other fruits can also be made to furnish a liquor.

An important industry in the United States as well as elsewhere is the production of brandy in its purest form called cognac. It is the direct

## DISTILLED WATER—DISTILLING INDUSTRY

product of the wine distillation. Its quality depends entirely upon the quality of the raw materials. The distillates of the wine distillation are characterized by being free from fusel oil. The aroma is due to cœnanth ether, which is also prepared artificially and is used in imitation cognacs. Cognac receives its brown color from being stored in oak casks.

The by-products of the wine distillation are also utilized, but, of course, furnish an inferior article. A fairly pure brandy can be made from the grape cakes, while the wine yeast furnishes a spirit of a very medium quality.

Gin, kummel, peppermint, etc., are common grain spirit distilled and flavored with juniper berries, caraway, peppermint, etc., mostly when the low wines are doubled. Above the pot-still there is a bell-shaped vessel, containing the flavoring material, and the vapors leaving the still pass over this flavoring material before they enter the dephlegmator or doubler.

The innumerable class of various sweet liqueurs, cordials, and ratafias are mostly only mixtures of good, almost fusel-free spirit with syrup and an aromatic substance, which produces the flavor. Most of them are obtained by steeping fruit or aromatic herbs in pure spirit and submitting the liquid to distillation. They are then colored and sweetened with sugar. The best known are absinthe, anisette, curaçoa, benedictine, boonecamp, crème de menthe, anise, and others.

Recipes for their preparation will be found in special works.

ERNST HANTKE,

*Industrial Chemical Institute of Milwaukee.*

**Distilled Water.** See DISTILLATION.

**Distilling Industry.** The extraordinary consumption of alcoholic liquors, and the extensive application of alcohol for all purposes, show it to be one of the most important substances produced by art. There is but one source of alcohol, its production arising from the fermentation of sugar or other saccharine matter obtained from plants containing either free sugar or starch convertible into sugar. In commerce, when made from maize or other grain, it is called grain-alcohol; from reindeer and Iceland moss, moss-alcohol; from potatoes and beets, root-alcohol; and from grapes, wine-alcohol.

The discovery of the art of distillation is attributed to the Arabian alchemists, the first mention of it occurring about the 11th century; but it was undoubtedly known and practised for centuries before by the Chinese. Brandy was named the water of life, and one of the early alchemists, in his enthusiasm over the discovery, declares that "this admirable essence is an emanation from the Divinity; an element newly revealed to man, but hid from antiquity because the human race was then too young to need this beverage, destined to revive the energies of modern decrepitude." Distillation consists in converting a liquid into vapor in a closed vessel by means of heat, and then conveying the vapor into a cool vessel, where it is reconverted into liquid. Strictly speaking, the spirits are not produced by the act of distillation, but are the result of the previous act of fermentation, distillation merely separating the spirits from the mixture in which they already exist.

The first product that reached the dignity of a place in commerce was so-called rectified

whiskey. It was the crude high wine after it had passed through a layer of charcoal, which largely extracted the fusel oil and made a product ready for sale. To this were frequently added flavoring extracts, the compound then being put into heavily charred barrels, and a little sugar coloring added to smooth over its rankness and fieriness. Following this process a redistilling apparatus was invented, by means of which the fusel oil was more thoroughly extracted from the spirits. To make it more palatable a certain proportion of old-fashioned Bourbon from Kentucky, or rye from Pennsylvania or Maryland, was added to give bouquet, flavor, and the appearance of genuine whiskey. This class of goods became known as redistilled whiskeys, and the proportion of these which were sold in commerce as against the genuine whiskeys of Kentucky and Pennsylvania was 15 to 1. In fact, the genuine goods made in Kentucky were used by dealers mainly for flavoring these so-called redistilled whiskeys. It may be well at this point to define Bourbon whiskey. The name now has a very wide significance. Originally it was whiskey distilled from Indian corn or rye in Bourbon County, Kentucky. As its fame spread, countless imitations sprang up, so that to-day Bourbon whiskey may be said to be whiskey distilled from corn to rye after the manner in which it is made in Bourbon County. The yield of Bourbon whiskey was then about three gallons to the bushel. It was heavy in body and flavor, qualities which made it very valuable in compounding; but it took many years of maturing to neutralize the fusel and other essential oils by the action of the atmosphere. The process of improvement was slow, and the trade recognized the fact that whiskeys required at least three years or more to attain full maturity and become ready for consumption. At this stage the science of mashing was greatly improved, increasing the yield and lessening the cost of production. This had the effect of popularizing Kentucky Bourbons among the masses, and instead of being employed so largely for compounding purposes they came into use on a larger scale as a beverage. It also became patent to distillers and dealers that a larger yield did not injure the quality, but, on the contrary, made the whiskey finer, as it contained less oils when made in quantity, and did not require so much time to develop its highest maturity. The pressure of competition has since induced some distillers of standing to sacrifice quality for quantity, and they have resorted to artificial means to produce the appearance of development. The whiskey which has given Kentucky its reputation is that known as sour mash, and there are a few distilling firms who are so jealous of their reputation that they continue to distil only genuine sour mash, yield being a secondary consideration. To attain a fine bouquet, with its accompanying flavor and body, they eschew all artificial means of forcing development, recognizing that the atmosphere is the only chemist that can bring about such results. These firms constitute the bulwark which maintains the reputation of Kentucky whiskeys. The larger number of the distillers look merely to the production of a deteriorated cheap grade, and the demoralization has taken such deep root that it is claimed by some producers that a year is all the time that is necessary to fit whiskeys for consumption. While the production of cheap



## DISTILLING INDUSTRY

grades has lowered the standard of Kentuckies, it has diffused the taste for them among the masses, causing the dealers to substitute them for redistilled whiskeys or so-called "domestics," which are but imitations of the genuine article. The present consumption of whiskeys of all grades made in Kentucky is estimated at about 25,000,000 gallons per annum.

The principal States in which ordinary spirits are produced are Illinois, Indiana, and Ohio.

From its greater availability and its cheapness, grain is in general use; while from fruits, which have a perishable nature and are non-available during the greater part of the year, there is distilled only a limited supply of apple, peach, and grape brandy, the State of California producing more than half of the fruit brandy made in this country. Molasses as a distiller's material yields nothing but rum. Of late, however, attempts have been made to produce pure spirits from that source, but, owing to the difficulty of eliminating the odor of rum the experiment is problematical. There is a very small production of rum, which is principally confined to New England; and the cheapness of grain spirits has tended to reduce the rum product to continually smaller dimensions. It is mainly manufactured for export purposes, very little being used in this country, as straight whiskeys have superseded this once popular beverage. It should be stated that common spirits require no aging, being ready for manufacturing purposes or for compounding the day that they come from the still, and they never improve. In most cases, after having been doctored up to produce the appearance of genuineness, they are palmed off as true whiskey and frequently they are audaciously placed on the market masquerading as sour mash.

In a review of American distilleries it is necessary that I should dwell for a moment upon the distilled spirits consumed in the arts, manufactures, and medicine in this country. Of these alcohol and cologne spirit take the lead, although high wines, whiskey, brandy, rum, and gin are also used. Pure alcohol cannot be obtained by ordinary distillation alone. The rectified spirit or alcohol of the pharmacopœias contains 9 per cent by weight of water in the United States, 16 per cent in Great Britain; proof-spirit or diluted alcohol, 54½ per cent by weight of water in the United States, 51 per cent in Great Britain. That alcohol is used in some localities as a beverage is undoubtedly true, and it is said that fully one half of the alcohol that finds its way to the Northwest is so consumed by Poles, Norwegians, Swedes, Finns, Hungarians, and Russians. It has been estimated that about 15 barrels of alcohol are consumed as a beverage daily in New York, but it is impossible to collect data upon which to found a reliable estimate on this point. The foreigners employed in the coal regions of Pennsylvania are drinkers of alcohol, and a considerable quantity is annually disposed of among them. A large percentage of the cost of pharmaceutical preparations arises from the distilled spirits used in their manufacture. Cologne spirit is used for many purposes for which alcohol would be unsuitable, and whiskey, brandy, rum, and gin form the basis of many proprietary medicines and of tinctures and medicinal wines. The amount of distilled spirits consumed in the arts and manufactures has been estimated at 15 per cent of all distilled spirits consumed.

The inherent repugnance to paying the heavy tax on alcoholic liquors imposed by the government has given rise to a large number of illicit distilleries throughout the country. Occasionally one of these secret stills is unearthed in the large cities, which indicates that there are always more or less of them in operation at the centres of population. In the mountain regions of the country, more particularly in the South, a large amount of distilled liquor is drunk that never has been recorded in the internal revenue department, or paid a penny of taxation. This criminal branch of the history of American distilling would make interesting reading on account of its picturesque character, but I can only allude to it here. For reasons that are obvious, no estimate worth having can be formed of the amount of distilled liquor in the United States that evades the government tax, but the figures would doubtless reach considerable magnitude.

The average quantity of grain used in the production of spirits during the last 10 years is about 22,000,000 bushels. Fully half the grain used is corn.

An important collateral industry is the feeding of cattle and hogs on the distillery slops. During the year ending 30 June 1894 this industry showed the following results:

### CATTLE FEED FROM DISTILLERIES.

	Pounds	Number
Number of cattle fed at regular grain distilleries .....		62,123
Increase in weight of cattle.....	14,449,516	
Average increase in weight.....	232	
Number of hogs fed.....		25,554
Increase in weight of hogs.....	1,901,748	
Average increase in weight.....	74	
Total increase in weight of cattle and hogs .....	16,351,264	
To this increase, Illinois contributed 8,000,000 pounds, or about one half.		

The entire production of distilled spirits in the United States for the year 1902 was 128,568,201 gallons; of this 26,209,804 gallons were Bourbon; 18,263,709 gallons, gin; 30,228,804 pure neutral spirits; 4,047,602 gallons, fruit brandy; 10,775,117 gallons, alcohol; and the other 3,000,000 gallons about equally divided between rum and gin.

When one compares these figures of more than 128,000,000 gallons, and the enormous revenue accruing to the benefit of the general taxpayers, with the petty production for private use by farmers a century back, the unexampled progress must be apparent without further comment. The spirit interest has interwoven itself with the life of the nation, so that it has become one of the most trustworthy sources of national income.

The necessity of increasing the revenue has fostered legislation favoring a higher tax, which unfortunately tends to bring among the masses inferior goods; for the higher the impost the lower the standard of quality must be in order to make up for the increase in cost. The purpose of every legislator should be to promote the public health and welfare by making it possible for producers to furnish a wholesome beverage, thoroughly matured, at the minimum cost. To tax it to death does not accomplish this object. It naturally forces the production of cheap imitations, which are made out of common spirit, and often sold the same day that they are made. That whiskey requires several years' time for properly maturing is universally acknowledged.

## DISTINGUISHED SERVICE ORDER — DISTRIBUTION

Those brands alone should be, in my opinion, allowed to be sold that can show natural aging.

In European countries alcoholic liquors, such as brandy, etc., are allowed to remain in bond until required by the trade for consumption. This plan always insures a large stock of matured goods in bond. There is no reason why our government should force the tax-payment at any given period.

In order to extend the trade into foreign countries, the privilege of bottling whiskeys in bond, and reducing them to such proof as may be required for commercial purposes, should be extended to the distillers of this country, as it is in Canada, where the government, alive to the interests of its manufacturers, affixes a stamp to each bottle, thus certifying to the genuineness of the contents. This would infuse confidence and promote export trade, as well as afford an opportunity for our citizens to secure a genuine and wholesome beverage. The trade in Canadian whiskeys has been steadily on the increase for years, owing to this privilege so wisely conferred by the Canadian government.

The history of the large combination of American distillers of alcoholic liquors is too recent and somewhat too complicated for me to dwell upon at this time. I have endeavored to show the enormous importance of the distilling industry not only to the government, but to the people of the United States, and my conclusions with reference to legislation on the subject of distilled spirits are arrived at with a sincere desire to foster and assist by intelligent means the progress of one of America's greatest industries.

JAS. E. PEPPER,

Jas. E. Pepper & Co., Lexington, Ky.

**Distinguished Service Order**, an order instituted by Queen Victoria 6 Sept. 1886 for the purpose of rewarding the naval and military officers mentioned in despatches for their distinguished service. Foreign officers who have been associated with British forces in naval and military operations are eligible as honorary members, and the order ranks next to the order of the Indian empire. The original badge was a gold cross, enameled white, edged gold, with the imperial crown on one side and the cipher V.R.I. on the other, each enclosed in a laurel wreath.

**Disto'ma**, a trematode, or fluke worm, which is a form of parasite frequently present in cattle and occasionally, in the form of the *Distoma hepaticum*, affecting man. At least eight or nine different species of distoma are known. The commonest ones, however, are the liver flukes of sheep and cattle. The *D. hepaticum*, or the large liver fluke, and the *D. lanceolatum* are the commonest forms. In sheep, the worm gives rise to the disease known as "rot," which is frequently fatal. In man, the affection known as distomiasis results when the gall-bladder and liver passages become infected. The liver is usually enlarged, there is very frequently hepatic pain, jaundice, diarrhoea, vomiting, and ascites. Infection takes place largely through eating plants in which the egg or embryo are found. The domestic cat has a distoma, and in India, Japan, China, and Egypt other forms of fluke are known. A *D. hamotobium*, or *Bilharzia*, is a special form that generally attacks the organs of the genito-urinary system and although rare, it is becoming sufficiently common in this

country, as a result of intercourse with the inhabitants of our Oriental possessions, to cause a certain amount of apprehension that its distribution may become more general.

**Disto'mea**. See LIVER-FLUKE; TREMATODA.

**Distress**, or **Distrain** (from the Latin *distingo*, to bind fast), is the taking of a personal chattel of a wrong-doer or a tenant, in order to obtain satisfaction for the wrong done, or for rent, taxes, or service due. The thing taken is also called a distress.

**Distribution**, in political economy, the apportioning of the products of industry among the people concerned. The methods of distribution have varied and do vary in accordance with the state of social development. They depend on legal as well as on economic conditions. They depend mainly on the ideas and institutions which prevail with reference to property in the three requisites of production—namely, land, labor, and capital. In countries where slavery prevailed, the slaveholder, as the owner alike of land, labor, and capital, disposed at his pleasure of the entire product of industry. Under the feudal system, the cultivator who was attached to the soil and had a fixed interest in it, was to render to his superiors dues in labor, in kind, and latterly in money, which were fixed by custom or authority. Where the system prevails of cultivators owning the soil, as in America, and among the peasant proprietors of the European continent, the owner, inasmuch as he unites in his own person land, labor, and capital, disposes of the entire product, except such portion as may be claimed by the money-lender. In cases where the state owns the land, the cultivator pays a rent or tax to the government, and retains the remainder. The *metayer* system still exists in Italy, the owner advancing the land and stock (in whole or in part), and receiving from the cultivator a fixed share of the produce, generally one half.

In Great Britain, and to a large extent in other countries with a highly developed industry, land, labor, and capital are supplied respectively by three different classes of persons, and their share in the produce is determined by free competition. The classical political economy of England may be defined as a description and analysis of such an economic condition of society. It claims to be a science only in so far as the competitive system prevails. The landlord's share in the produce thus determined is called rent; that of the capitalist and employer is designated as interest, profit, earnings of management, etc.; the laborer's share is wages. It should be pointed out that under such a system the central function in distribution, as well as in production, rests with the employer. As he originates and controls the productive process, so in the distributive process he settles with landlord and laborer, and then disposes of the produce. If the employer operates in whole or in part with borrowed capital, interest on that capital must also be deducted from his share of the produce. All these claims satisfied, the amount of his share will depend on his success in disposing of the product.

Whatever the arrangements regarding property and the distribution of the fruits of industry may be, account must be taken of the share claimed by the government in the form of taxes, for the maintenance of the army and navy and

## DISTRIBUTION OF ANIMALS

other means of defense, for justice and police, and for education, etc.

It is now admitted that economists have bestowed excessive attention on production, to the neglect of the problem of distribution. But the reproach has a much wider application than to economists merely, for it may generally be said that while modern communities have enormously increased their productive forces, they have not yet solved the problem of distribution. The enormous inequalities of distribution are a danger felt by all thinking men. It is a question which is more and more challenging the attention of statesmen and economists. An economic system can be satisfactory only when a high standard of production finds its complement in a reasonable and equitable distribution, supplying to the mass of the citizens the means for their due physical, intellectual, and moral development. For a special method of seeking to secure the equitable distribution of profits among those who earn them, see CO-OPERATION.

**Distribution of Animals.** See ZOÖGEOGRAPHY.

**Distribution of Animals in North America.** Knowledge upon this subject is deemed of such importance to the public that for several years the Department of Agriculture at Washington has been making scientific investigations, and publishing full reports of its observations and experiments.

When the boundaries of the life zones and areas are accurately mapped, the agriculturist, knowing the faunal area, and the beneficial or harmful animals, birds, and insects, can prepare in advance for the protection of crops. If no means have yet been found of exterminating an animal injurious to a certain crop, the first thing will be to ascertain the exact localities in which such animals exist, and those in which they do not. Mr. L. O. Howard, writing of the San José orange scale-insect, says: "It may prove to be a significant fact that, although nursery stock affected by this scale has for six or seven years back been sent to all the fruit-growing regions of the eastern States, according to our present information the scale has established itself only in regions contained within the so-called Austral life zone. Mapping the points of establishment, it is very interesting to see how accurately this distribution has been followed. This fact will relieve New England fruit-growers north of southern Connecticut; those inhabiting the greater portion of Pennsylvania, except in the southeastern one fifth and a western strip; those in New York, except for the strip up the Hudson River, and the loop which comes in from the northwest and includes the counties bordering Lake Ontario on the south, as well as those inhabiting the northern portion of the lower peninsula of Michigan and all of northern Wisconsin, from any fear of this insect. Such a condition of affairs would seem almost too good to be true, but the possibility of its truth is suggested by what we know up to the present time."

Agriculturists living within the area likely to be invaded by certain animals, large or small, can escape by planting crops not affected, while those living outside may largely increase their revenues by giving special attention to the cultivation of the crops that are affected in the adjacent life zone. A knowledge of the natural life areas and of their distinctive species and crops will enable farmers and fruit-growers to select

the products best adapted to their localities, will help them in their battle with harmful species, and will thus put an end to the present indiscriminate experimentation by which hundreds of thousands, if not millions, of dollars are needlessly expended each year.

Previous to the beginning of the scientific work by the Department of Agriculture, the faunal areas east of the Mississippi valley had been recognized and in a general way defined, and attempts had been made to divide the country as a whole into areas of higher grade. Most zoological writers had agreed in apportioning the United States into three primary provinces or regions—an eastern, reaching from the Atlantic to the plains; a central, from the eastern edge of the plains to the Sierra Nevada and Cascade Range; and a western, or Pacific, from the latter to the Pacific Ocean. It soon became apparent, however, that in order to gain a clear conception of the facts and phenomena of distribution a careful study of the subject must be made in the field, where the actual range of mammals, birds, reptiles, and insects could be ascertained and the distinctive areas contrasted. With this object in view, and with the sanction and approval of the Hon. J. M. Rusk, secretary of agriculture, and the Hon. Edwin Willits, assistant secretary, an experimental biological survey was made in the summer of 1889. The area selected was the San Francisco Mountain region in Arizona, which, because of its isolation, altitude, southern position, and proximity to an arid desert, was believed to offer unusual facilities for a successful study of the problems involved. The area of which a careful survey was made comprises about 5,000 square miles, and enough additional territory was examined to make in all nearly 12,000 square miles. One result of this first survey was the complete overthrow of the main faunal areas previously recognized in the United States, and a radical change in the conception of the principles involved. In ascending the mountain a succession of climatic belts were traversed, similar to those encountered in journeying northward from the southern States to the polar sea, and each belt was found to be inhabited by a distinctive set of animals. The more important results of the survey may be briefly summarized as follows: (1) It was demonstrated that mammals, birds, reptiles, and insects are distributed by association of species; (2) that between the desert of the Little Colorado and the summit of San Francisco Mountain there are seven distinct zones or belts of animal life; and (3) on comparing the principal facts of distribution on this mountain with corresponding facts over the country at large, three important truths became apparent: (a) That the several life zones of the mountain could be correlated with corresponding zones long recognized in the eastern United States; (b) that these same zones are really of transcontinental extent, though never before recognized in the West; and (c) that the fauna of North America as a whole is properly divisible into but two primary life regions, a northern, or Boreal, and a southern, or Austral, both stretching across the continent from ocean to ocean.

The results of this experimental biological survey were so important and far-reaching as completely to revolutionize current notions of distribution. It was perceived that the Austral

## DISTRIBUTION OF ANIMALS

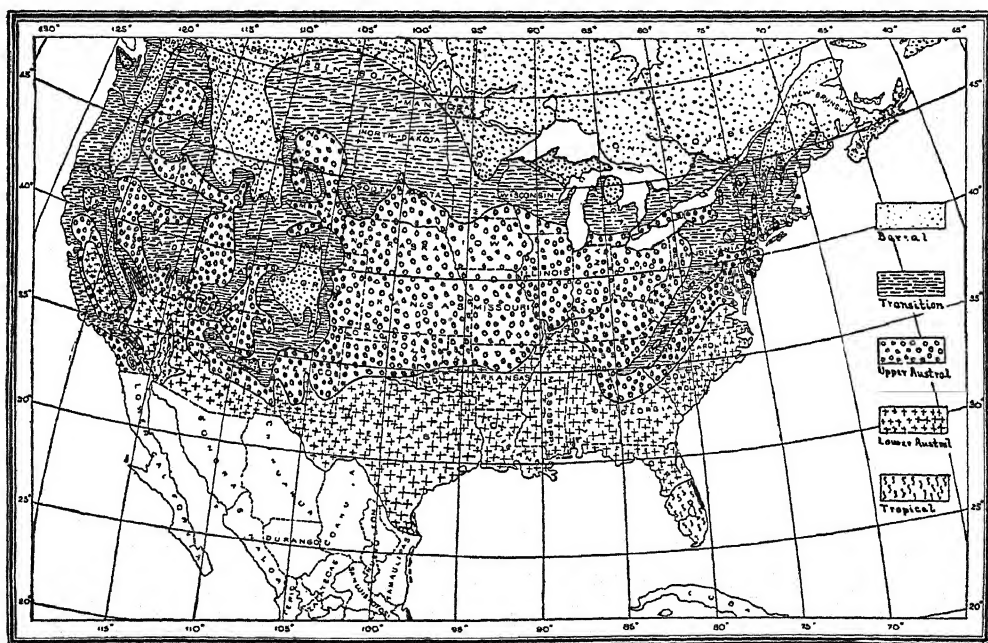
as well as the Boreal elements in the fauna are distributed in transcontinental belts; hence the arbitrary and irrational division of the United States into Eastern, Central, and Western "provinces" gave way before a rational system, based on a knowledge of the actual facts of distribution, which were found to conform to the general principle of temperature control early recognized by Humboldt and others.

In 1890 a biological reconnaissance was made of south-central Idaho, the area covered comprising about 20,000 square miles. The zones recognized were the same as in the San Francisco Mountain survey, except that the lowermost was absent. In the report on this expedition the courses of the several zones were described and the characteristic species of animals enumerated. In 1891 the most comprehensive and thorough biological survey ever undertaken was made by the division. An area embracing 100,000 square miles, stretching from

teristic of widely remote regions. Thus, in one place on the east side of the Sierra all of the life zones of North America, from the tableland of Mexico to the polar sea, may be crossed in a distance of only 10 miles.

This expedition, which came to be known as the Death Valley expedition, determined the distinctive species of each zone, traced the courses of the several zones from California to the Colorado Plateau, and made large collections of the mammals, birds, reptiles, and insects, which collections are now deposited in the United States National Museum. The zones were segregated into the two great transcontinental regions—Boreal and Austral (see map).

In 1892 the northern boundary of the lower Austral zone was traced from New Mexico eastward across Texas, Indian Territory, and Arkansas to the Mississippi River. In 1893 a study was made, in the interest of biology, of Wyoming, a large part of which State was



Map showing life zones of the United States.

the Pacific coast to the 113th meridian and from lat. 34° to lat. 38°, was chosen as the field of operations. This area comprises the greater part of southern California and Nevada, southwestern Utah, and the northwestern corner of Arizona, thus including all of the torrid desert valleys and ranges between the Sierra Nevada and the Colorado Plateau. It embraces also the highest and lowest lands within the United States—from Death Valley, nearly 500 feet below the level of the sea, to the lofty snow-capped peaks of the high Sierra, culminating in Mount Whitney at an altitude of nearly 15,000 feet. The region was selected because of the exceptional advantages it offered for studying the distribution of animals in relation to the effects of temperature and humidity at different altitudes. The close proximity of desert valleys and lofty mountains brings near together species which in a more level country are charac-

found to be from 1,000 to 3,000 feet lower than represented on current maps, and consequently the climate is warmer than was supposed by those not residents of the State. The Wind River and Big Horn basins and the plains east of the Big Horn Mountains were found to be upper Austral. Work was done also on the Great Plains in Kansas, Nebraska, the Dakotas, Utah, and on the tableland of Mexico. During the year 1894 a study was made of the greater part of Montana, and the work was continued in South Dakota and in the plateau region of Arizona. In Arizona two sections were run from the plateau south to the lower Austral.

In the annual report of the Department of Agriculture for this division for 1893, the seven life zones of North America, including the tropical, were characterized with special reference to eastern North America. Beginning at the north, these zones may be described as follows:

## DISTRIBUTION OF PLANTS — DISTRICT

1. The Arctic or Arctic-Alpine zone lies above the limit of tree-growth, and is characterized by such animals as the snow-bunting, snowy owl, white ptarmigan, polar bear, arctic fox, and barren-ground caribou or reindeer.

2. The Hudsonian zone comprises the northern or higher parts of the great transcontinental coniferous forest, and is inhabited by the wolverene, woodland caribou, moose, great northern shrike, pine bullfinch, white-wing cross-bill, white-crowned sparrow, and fox sparrow.

3. The Canadian zone comprises the southern or lower part of the great transcontinental coniferous forest. Among the characteristic mammals and birds are the porcupine, varying hare, red squirrel, white-throated sparrow, and yellow-rumped warbler.

4. The Transition zone is the belt in which Boreal and Austral elements overlap. It covers the greater part of New England, New York, Pennsylvania, Wisconsin, and southern Michigan, and pushes south along the Alleghenies to the extreme northern part of Georgia. Here are the southern mole and cottontail rabbit, the oriole, bluebird, catbird, thrasher, chewink, and wood-thrush, the hermit and Wilson's thrushes, solitary vireo, bobolink, red squirrel, jumping mouse, chipmunk, and star nosed mole.

5. The Carolinian zone covers the larger part of the Middle States except the mountains; on the Atlantic coast it reaches from near the mouth of Chesapeake Bay to southern Connecticut, and pushes still farther north in the valleys of the Hudson and Connecticut rivers. It is the region in which is found the gray fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnat-catcher, and yellow-breasted chat.

6. The Austroriparian zone covers the greater part of the South Atlantic and Gulf States, beginning at the mouth of Chesapeake Bay. Here the mocking-bird, painted bunting, red-cockaded woodpecker, and chuck-will's-widow are characteristic birds, and the cotton-rats, rice-field rats, wood-rats, little spotted skunks, and free-tailed bats are common mammals.

7. The Tropical region within the United States is restricted to southern Florida, extreme southeast Texas (along the lower Rio Grande and Gulf coast), and the valley of the lower Colorado River in Arizona and California. Among the birds may be mentioned the white-crowned pigeon, zenaida dove, quail doves, a Bahaman vireo, a Bahaman honey-creeper, and caracara eagle.

Since the time of Humboldt, at least, the fact has been recognized that animals are not universally distributed over the earth, but disappear along more or less definite lines which prominently indicate changes in temperature ungenial to certain species; but exactly what temperatures exert the controlling influence, and how they can be measured, have only recently been discovered. Until recently the mistake was made of assembling all the temperature data in accordance with a single hypothetical law. Then a radically different plan was tried: the temperature data were plotted in accordance with two widely different principles—one with reference to the northern, the other to the southern, boundaries of the zones. This departure was suggested by a somewhat tardy recognition of the fundamental facts of the distribution discovered in 1889; namely, that animals are themselves distributed from two directions—

Boreal species from the north, and Austral species from the south. It seemed reasonable to infer, therefore, that northward distribution should be governed by one set of temperatures, and southward distribution by another. When the sums of the positive temperatures for a large number of localities in the United States were plotted on a large-scale map it was found that isotherms could be drawn that correspond almost exactly with the northern boundaries of the several zones. In the case of the southern boundaries a greater difficulty was encountered, for no data had been published bearing on the temperature control of southward distribution. At the same time it seemed evident, from data previously collected by the division, that species are limited in their southward distribution by the mean temperature of a brief period during the hottest part of the summer. For experimental purposes the mean normal temperature of the hottest six consecutive weeks of summer was assumed to be the factor desired, and this temperature was plotted for a large number of localities. Isotherms were then drawn which marked the southern boundaries of the several zones along the Atlantic coast, and it was found that in ranging westward these isotherms conformed throughout to the tortuous boundaries of the Boreal, Transition, and Upper Austral zones, previously mapped from a study of the actual distribution of animals.

The most zealous upholder of the laws of distribution of animals does not claim that the subject has been disposed of in all its details; but it is believed that the general principles controlling the geographical distribution of animals have been discovered, and that they may be expressed as follows:

1. In northward distribution animals are restricted by the sum of the positive temperatures for the entire season of growth and reproduction. 2. In southward distribution they are restricted by the mean temperature of a brief period during the hottest part of the year. It is believed that these two principles cover the fundamental facts of distribution. The modifications of land and water are always to be considered. Consult: Reports of United States Department of Agriculture; especially, 'North American Fauna' (No. 3, 1890); 'Insect Life' (VII. No. 4, 1895); 'North American Fauna' (No. 5, 1891); 'North American Fauna' (No. 7, 1893); also Allen, 'Geological Distribution of the Mammalia' (Bulletin U. S. Geological Survey No. 4, Vol. IV.); Baird, 'Distribution and Migration of North American Birds' (Series 2, Vol. XII. of 'American Journal of Science and Arts'); and Coues, 'Fur-bearing Animals,' etc.

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**Distribution of Plants.** See PLANT GEOGRAPHY.

**District,** in the United States. The term has been used historically and currently in five legal senses, besides the vague one of "section of country." (1) Organized bodies of territory administered by the Federal government, not populous or compact enough for Territorial institutions, or for other reasons withdrawn from that system. The District of Columbia, first district, then Territory, then district again; Alaska before its Territorial organization; and from 1804 to 1812 that portion of the Louisiana



## DISTRICT OF COLUMBIA

Purchase north of the present boundaries of the State of Louisiana, are instances. (2) The counties in South Carolina were called districts till late in their history. (3) A State or portion of a State in its function as the seat of jurisdiction of a United States court. (See DISTRICT COURT.) Judicial districts never cross State lines. (4) Politically, a section of a State or municipality fixed by law for purposes of legislative or congressional representation. Where the former is based on counties, it is always a defined part of a county, never crossing the lines; if on towns, usually the State senate is chosen from districts made up of certain towns or parts of cities, equally, never confounding two. The Congressional districts are marked off by the State legislature after the new apportionment of a census; sometimes in such a way as to give the party then in control of the legislature a greater number of congressmen than its share of the popular vote entitles it to. (See GERRYMANDER.) (5) A taxing district, by decision of the Supreme Court, is any section of a State described in a statute or order as to be assessed, without respect to political divisions. A remarkable instance was the abandonment of its city charter by Memphis, Tenn., when plundered into ruin by a political ring, and constituting itself the Taxing District of Shelby County, to escape suits against the city as a corporation.

**District of Columbia**, the national capital and its adjoining territory, owned and administered directly by the United States government, to prevent its actions being hampered by conflicts with local jurisdictions. It consists of 60 square miles of land and 10 of water on the eastern side of the Potomac, at the head of deep-water navigation; an enclave in Maryland, with three rectangular sides and the fourth following the lines of the river, besides the islands in the tidal river. Near the southern side of the district, forming the eastern and southern boundary of the city of Washington, is the large tidal estuary of Anacostia River or the eastern branch of the Potomac; the northwest boundary is formed by Rock Creek, separating Washington proper from Georgetown. There are several brooks. The district is flat and marshy for some distance back, then rises into gentle hills and swells; there is pleasing scenery along Rock Creek. The geological formation is Cretaceous, overlaid with drift; in the latter has been found the conglomerate called breccia, from which handsome columns have been carved, used in the capitol. The soil is light, and especially suitable for market-gardening, to which with dairying and the pasturage for the cows it is chiefly devoted, outside the built-up sections. The nature of the capital as a "court city" gives flower-gardening a great importance, and over \$500,000 worth are sold annually. The farms are very small—about 35 acres for white and 18 for colored occupants. But little over a fifth of the surface is in farms, however; the city and its suburban villages, the great National Park, and reserved grounds of various kinds, taking up most of it. The climate is excessively variable, but generally humid and warm. The rainfall averages 50 inches a year.

The District originated in the politics of the Confederation time. Until the adoption of the Constitution, the Continental Congress assembled on 10 occasions at 8 different places in succession, at Philadelphia, Baltimore, Phila-

delphia, Lancaster, Pa., York, Pa., Philadelphia, Princeton, N. J., Annapolis, Md., Trenton, N. J., New York. The first five were during the Revolution. On 21 June 1783 a band of unpaid militia broke up the session in Philadelphia by hooting the members and pointing muskets in at the windows. This emphasized the need of a district guarded by Federal troops, and on 7 October Congress resolved to erect a building near the falls of the Delaware (Trenton). The jealousy of the South, however, demanded one also near the falls of the Potomac, and alternate meetings in the two. Finally a majority abolished the second proposition, and a committee was appointed to lay out a town as first voted. There was no money under the Confederation, however, to build or do anything else, and no action was taken on the committee's report. It had been voted to meet in New York till the Federal town was ready; but this was disliked from fear of the "money power" corrupting or overbearing Congress. Philadelphia was proposed, but objected to by the southerners because the Quakers favored abolition. The first Congress under the Constitution revived the government-district plan, but on the banks of the Susquehanna. Finally Jefferson gave a dinner and arranged a "log-roll": two anti-Federalists from the Potomac region, who had voted against the assumption of the State debts by the national government, changed their votes on condition of the Federalists voting to fix the new capital on the Potomac, after remaining 10 years at Philadelphia. The act was passed as agreed 28 June 1790, for establishing the seat of government "at some place between the mouths of the Eastern Branch and the Connogocheague." The first session of Congress was to be held in the new place the first Monday in November 1800. Maryland in 1788 ceded Washington County, and Virginia in 1789 Alexandria County, forming a district 10 miles square; Washington in person laid it out under the Act of 30 March 1791 (having previously sold all his lands in the vicinity). The territory selected included the site of Powhatan's village, Anacostan or Nacochtank; also the existent village of Georgetown, laid out in 1751 and incorporated in 1789,—both on the Maryland side; and on the Virginia side, Alexandria, formerly Belhaven. The site of the new capital itself had been the plantation of one Pope, classically inclined, who by a curious provision called his hill the Capitol and a brook near by the Tiber. Until 9 September the site was called "The Federal City"; then, by order of three commissioners appointed by President Washington, the district was named "The Territory of Columbia," and the city "The City of Washington." For the latter, see that title; also CAPITOL, where is noted the project, after its burning by the British, of removing the capital north, which was carried by the speaker's casting vote, but buried in committee. In 1846 no Federal buildings having been erected on the Virginia side, nor likely to be, Alexandria County was retroceded to that State. In 1871 the business men of the District, fretting under their political nullity, it was constituted a Territory with a governor and legislature, and delegates in Congress; but was at once seized upon by a ring of speculators who obtained control of its government and plundered it into bankruptcy. In 1874 the territorial government was



## DISTRICT OF COLUMBIA — DITTON

abolished and direct government by Congress restored, through three commissioners appointed by the President and confirmed by the senate.

The commission of 1874 was a temporary government; in co-operation with Congress and the citizens of the District, it framed as a permanent system the Act of June 1878, which the Supreme Court has pronounced "the constitution of the District of Columbia." Under this Act half the expenses of the District, previously laid entirely upon the residents, are paid by the national government, as the owner of more than half the real estate. There is no popular suffrage, the entire executive government being in the hands of commissioners appointed by Congress; they recommend legislation and appropriations to the latter, which in turn consults them in the same matters. The government, though not appointed by popular vote, is nevertheless one steadily deferent to and swayed by public opinion; and so excellent that agitations for restoration of suffrage meet no support. The judiciary of the District dates from 1801.

*Population.* — 1800: Washington, 8,144; Alexandria, 5,949. 1810: Washington, 15,471; Alexandria, 8,552. 1820: Washington, 23,336; Alexandria, 9,703. 1830: Washington, 30,261; Alexandria, 9,573. 1840: Washington, 33,745; Alexandria, 9,967. 1850: Washington, 51,687; 1860 (same), 75,080; 1870 (same), 131,700; 1880 (District of Columbia), 177,624; 1890 (same), 230,392; 1900 (same), 278,718, of whom 218,196 were in Washington proper and 14,549 in Georgetown. Of these, 20,119 only were foreign born; but 87,186 were colored.

**District of Columbia, Courts of.** See COURT.

**District Courts.** See COURT.

**Ditch**, a trench or fosse on the outside of a fortification or earthwork, serving as an obstacle to the assailant and furnishing earth (*déblai*) for the parapet (*remblai*). It is from 90 feet to 150 feet broad, in regular fortifications, and 10 to 12 feet deep below the natural level of the ground. The fosse around a Roman encampment was usually 9 feet broad and 7 feet deep; but if an attack was apprehended it was made 13 feet wide and 12 feet deep. The agger, or parapet, of the encampment was raised from the earth to the fosse, and was crowned with a row of sharp stakes.

**Ditchfield, Peter Hampson**, English author and clergyman: b. Westhaughton, Lancashire, 20 April 1854. He was educated at Oriel College, Oxford, entered the Anglican priesthood, and has been rector of Barkham, Berkshire, from 1886. He has published: 'An Ecclesiastical History of Reading' (1883); 'The Romance of Mathematics' (1886); 'Our English Villages' (1890); 'Old English Sports and Customs' (1891); 'The National Churches Series—Germany, Spain, Ireland, Netherlands, Italy, France, Scotland, America, England' (1891-7); 'Guide to Berkshire' (1892); 'Sigund,' a cantata (1893); 'Books Fatal to Their Authors' (1895); 'Old English Customs Extant at the Present Time' (1896); 'Bygone Berkshire' (1896); 'The Sorceress of Paris' (1896); 'The Story of Our English Towns' (1897); 'Memorials of Old Buckinghamshire' (1902).

**Dithyrambus**, or **Dithyramb**, in Greek literature, a form of lyric or poem sung in honor

of the god Bacchus, at his festivals. Since these festivals were celebrated with all the extravagance which would please the god of wine, the dithyrambus employed in his worship naturally breathed the same frenzy. The character of the dithyrambus therefore requires bold images and lofty periods. The more apparent disorder it contains, the more it partakes of the fire of intoxication, the better it sustains the true dithyrambic character. In the wild Phrygian music it was sung in choirs. Arion of Methymne, in the island of Lesbos, was the first to give a regular choral form to it, about 625 B.C. Lasos of Hermione is said to have been the first who introduced dithyrambic contests into the public games. The expression *dithyrambic poem* denotes, also, any lyric poem filled with a wild and impetuous enthusiasm, as is the case with many odes of Pindar.

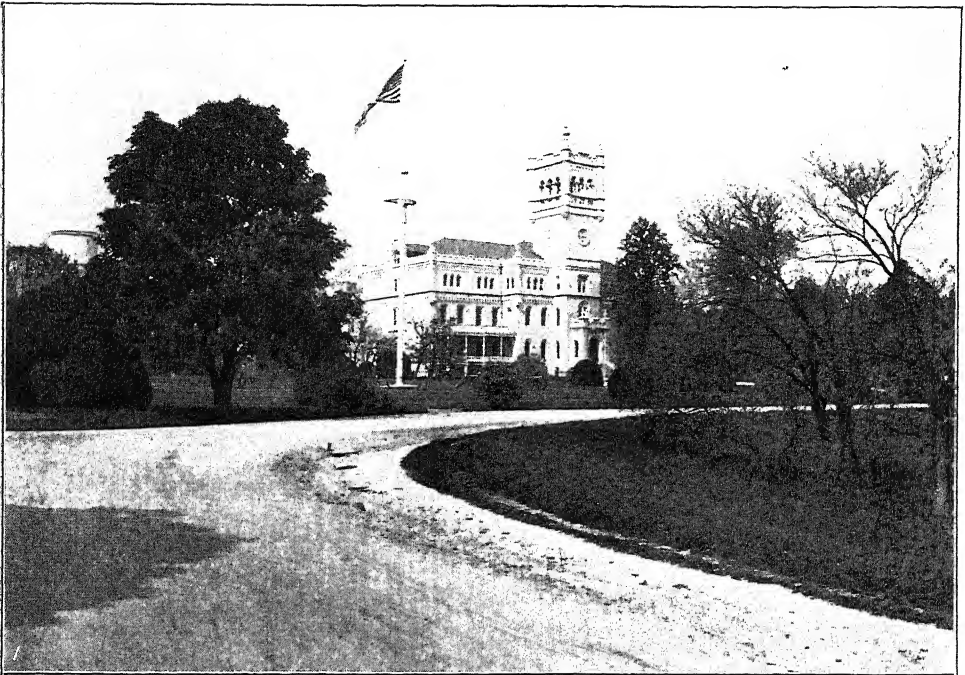
**Ditmarsh**, or **Ditmarshes** (Ger. *Dithmarschen*, "the German marshes"), a district of Holstein in Germany, along the German Ocean, between the mouths of the Elbe and the Eider, so little raised above the sea as to require the protection of strong embankments. Area, 500 square miles. Pop. over 80,000.

**Dittany** (*Dictamnus*), a genus of plants belonging to the rue family (*Rutaceæ*). The members of this genus are beautiful plants, with alternate compound imparipinnate leaves. Their flowers are large, and white or purplish in color. They are arranged in racemes, the peduncles and pedicels of which secrete in numerous more or less prominent glands the essential oil which gives these plants their odor. Their roots were formerly used in medicine; their flowers furnish the perfumer with a fragrant distilled water. The most common species is the *Dictamnus fraxinella*, the leaves of which greatly resemble those of the ash (whence its specific name, from the Latin *fraxinus*, an ash-tree). It is said that in hot weather the odoriferous particles thrown off from this plant form an inflammable atmosphere around it; and if a lighted candle be brought near the plant, especially in a time of drought, there is a burst of flame around the plant. The dittany of the United States (*Cumula origanoides*) belongs to the mint family (*Labiata*), and is the only one of the 15 species of the genus native in America. It is an exceedingly aromatic herb, with purple-pink flowers arrayed in loose clusters. It is found from New York to Florida, and west to western Georgia and Ohio. The dittany of Crete is *Origanum dictamnus*, and the bastard dittany is a species of *Marrubium* (hoarhound), both labiates.

**Ditters von Dittersdorf**, dît'tèrs fôn dît'tèrs-dôrf, **Karl**, German musical composer: b. Vienna 2 Nov. 1739; d. 31 Oct. 1799. He is particularly distinguished in comic compositions, and perhaps unrivaled in this branch of music among the German composers. Several of his operas were represented with great applause even in Italy: 'Doktor und Apotheker'; 'Betrug durch Aberglauben'; and 'Die Liebe im Irrenhause,' were among the most successful of these. He also acquired considerable reputation by his oratorio 'Esther,' which secured his elevation to a place among the Austrian nobility.

**Ditton**, **Humphrey**, English mathematician: b. Salisbury 29 May 1675; d. 15 Oct. 1715. Through Sir Isaac Newton he received the ap-

DISTRICT OF COLUMBIA.



1. Soldiers' Home.

2. Falls of the Potomac.



pointment of mathematical master at Christ's Hospital, which appointment he retained till his death. In 1714, in conjunction with Whiston, he published a new method for finding the longitude at sea, as well as on land. He was the author of several mathematical works, the principal of which are the following: 'General Laws and Nature of Motion' (1705); 'Institution of Fluxions' (1706); 'Treatise on Perspective, Demonstrative and Practical' (1712); 'New Law of Fluids' (1714). He also wrote a 'Discourse Concerning the Resurrection of Jesus Christ' (1712), which was afterward translated into several languages.

**Diu**, dé'oo, an island of India, belonging to the Portuguese, off the south extremity of Gujerat. On a point on the east end of the island is the fortified town of Diu. Pop. 12,636.

**Diuretics**, drugs used to increase the elimination of urine. Such diuretics may be direct, in that they affect the renal epithelium, or indirect, in that they increase the blood pressure within the kidney and thus increase the urine elimination. This is largely an artificial classification, since it would seem that urine is always a true secretion and not a filtrate, and the renal epithelium must always be involved in the process of manufacture. Still it is a subdivision that has received wide recognition. Diuretics are frequently used in a number of heart, lung, and kidney diseases; because in the normal elimination of urine certain catabolic products are cast off from the body in the urine. If they are retained, however, they give rise to various degrees of intoxication, which may be even fatal. Thus in certain heart diseases, either from insufficient pressure, or from accompanying disease of the blood vessels, the elimination of the ordinary amount of urinary solids may be insufficient and result in poisoning. Hence diuretics, by increasing the elimination of urine, increase the output of these poisonous products. In all patients for whom diuretics are useful, certain concomitant drugs are of benefit. Those namely that empty the bowels freely and those that increase the elimination of perspiration. Of the numerous diuretics the saline salts of potassium, sodium, lithium, calcium, magnesium, the heart tonics, such as digitalis, adonis, caffeine, strophanthus convallaria, theobromine, are most frequently employed. To this list calomel, copaiba, cubebs, juniper, oil of sandal, and other irritating diuretics might be added. Injections of hot water into the rectum cause a pronounced diuresis, and this method is now recognized to be one of the best modes of inducing an increased elimination of urine.

**Divan**. 1. With the Turks, the highest council of state: the Turkish ministry. Every pasha has also a divan. 2. In the large mansions of the rich in Turkey a divan signifies a large hall for the reception of visitors, which communicates with a number of ante-chambers surrounding it, and which contains sofas placed round the walls, often adorned with costly tapestry and richly embroidered cushions. 3. Divan, with the Arabs, Persians, and Turks, is used to denote a complete collection of lyric poems, which they call ghazals, and through each of which one single rhyme extends: they never exceed the length of 14 strophes. Such a collection is complete if there are as many divisions as there are letters in the alphabet of the

respective languages; and each division contains at least one poem, the rhymes of which terminate with the letter under which the division falls; some letters are excluded, as few or no words end in them. Goethe applied this name to a collection of poems by himself, written in the eastern fashion. 4. The word is also applied to a soft cushioned seat for the accommodation of several persons.

**Diver**, a name properly restricted in ornithology to birds of the family *Colymbidae* (q.v.), but applied with little discrimination to various other water-birds of similar habits. The compact, depressed body, powerful, posteriorly placed legs with fully webbed feet, the long sinuous neck, and stout acute bill admirably adapt them for aquatic life and the pursuit of fish. They are strong flyers, but on the land are awkward and stand nearly upright. The plumage is peculiarly compact and resistant to water. Three species are well known in the United States. The great northern diver or loon, *Urinator (Colymbus) imber*, is a large bird, sometimes attaining a length of three feet. Above the plumage is a lustrous black with green and purple metallic reflections, and marked with numerous white spots and streaks; below, a nearly pure white. The loon is distributed throughout the entire northern hemisphere on both fresh and salt waters, and during the winter is found in all parts of the United States, in the northernmost of which it breeds, building its nest among the rushes near or in the water, and laying as a rule but two eggs. The loon is best known by the extreme facility with which it dives at the flash of a gun, thus escaping injury while the ball speeds harmlessly overhead, and for its wild resonant cry, about which many traditions and myths have arisen. It can remain several minutes under water, and swim 100 yards before rising to the surface for air.

The red-throated diver (*U. lumme* or *C. septentrionalis*) is eight or nine inches shorter than the loon, of a rusty black, with profuse small white spots above, white below, with a large distinct chestnut-colored patch on the lower part of the throat. It is distributed like the loon, but is rather more northern, and is found in the United States in the winter only. The black-throated diver (*U. arcticus*) is intermediate between the other two species, from which it is distinguished by a blue-black neck-patch. It is a high northern species, and is represented within the limits of the United States chiefly by a western variety which occurs abundantly on the Pacific coast in winter. Consult: Baird, Brown, and Ridgway, 'Water Birds' (1884); Elliot, 'The Wild Fowl of the United States' (1898).

**Dives**, dī'vēz (Lat. "rich"), the name popularly adopted for the "rich man" in the parable of the rich man and Lazarus, Luke xvi.

**Divi-divi**, dé'vê-dé'vê, Libi-dibi, or Libi-divi, the astringent bean-pods of *Casalpinia coriaria*, a tree which grows in northern South America, in the Antilles, and in Mexico, and a member of the family which yields sapan, brazil, and other red woods. The pods are about one inch broad and three inches long, but are generally bent or curled up, and tend to scale off on the outside. They have a pale brown color with a tinge of yellow; sometimes they are spotted and black, and then they are not so good. They are very rich in tannin (especially

## DIVIDE — DIVINE RIGHT

in the pod), good samples containing as much as 40 to 50 per cent, and form one of the best tanning materials. They are largely used in calico-printing for blacks and dark shades.

**Divide, The Great, or The Continental Divide**, names given to an elevated ridge of land in the United States where occurs the parting of the waters which flow to the Atlantic and the Pacific oceans. The name, "The Great Divide," is now commonly applied to a broader extent of country than the Continental Divide or watershed proper. It comprises that region in Montana and Wyoming wherein so many of the large rivers of the United States have their source, and which possesses within itself nearly all the characteristics of a continent. The arrangement of the elevated land masses in relation to the valleys and plateaus is continental; the temperature and vegetation vary almost from that of the tropics to the frigid zones; its mineral wealth is enormous; and its wild animals and great varieties of fish make it the paradise of the hunter and the angler. Its waters flow to the Gulf, the Atlantic, and the Pacific oceans, and streams rise on its eastern border-land whose waters flow to the Arctic Ocean. It is the natural geographical centre of North America.

**Dividend**, in arithmetic, a number to be divided by another; thus, if 20 is to be divided by 4, 20 is the dividend, and 4 the divisor. In commerce the fractional part of the assets of a bankrupt which is paid to the creditor in proportion to the amount of the debt which he has proved against the estate of the debtor; or the sum periodically paid as interest on loans, debentures, etc., or distributed as profit on the capital of a railway or other company. The sum to be divided is broken up into as many portions as there are bondholders or shareholders to claim them, and the fractional part falling to each holder bears the same proportion to the whole dividend as the amount of stock or shares he holds bears to the whole capital.

**Dividing Engine**, a machine for marking the divisions on the scales of scientific, mathematical, or other instruments. Some of these machines perform work of extraordinary fineness and accuracy. In making astronomical instruments, spectrometres, metre rods, and such exact instruments, the dividing engine is almost indispensable. Joseph von Fraunhofer was the first to make the instrument for ruling gratings, but others soon followed his lead. See FRAUNHOFER, JOSEPH VON; MICHELSON; ROWLAND; RUTHERFORD; and article on SCREW.

**Dividing Range, Great**, an Australian chain of mountains, forming the watershed between the rivers flowing into the Pacific and those running westward. It stretches from Cape York on the north to Wilson's Promontory on the south.

**Divina Commedia**, *dē-vē'nā kōm-mā'dē-ā*. See DANTE.

**Divination** (Lat. *divinatio*), the art or act of foretelling future events, or discovering things secret or obscure, by the aid of superior beings, or by other than human means. The derivation of the word indicates a belief that omens are sent by divine interposition. Natural divination was anciently thought to come by divine afflatus; artificial divination, by signs, omens, etc. At

an early time divination formed a regular science, intimately allied with religion and furnished with rules and regulations. Even though divination did not have its origin in fraud, it became a fruitful source of imposition. Moses prohibited divination expressly (Deut. xviii. 11). Saul expelled "those that had familiar spirits, and the wizards," from his kingdom; yet he was weak enough to consult the famous witch of Endor shortly before the battle in which he fell. The Egyptians and Greeks had their oracles. With the Romans divination and witchcraft were brought into a kind of system, and constituted part of their religion. (See AUGURS and ARUSPICES.) The ancient Germans had consecrated white horses, from whose snorting and neighing they drew favorable or unfavorable signs. They also followed the guidance of prophetesses, whom they called *Atruncs*. Many Christians, from the period of the 3d century, adopted the *sortes biblicæ* or *sortes sanctorum* — a mode of judging of the future by opening the Scriptures at random, and forming an opinion from the passage on which the eye happened to fall. (See BIBLIOMANCY.) In early times Virgil's *Æneid* was also used for the same purpose (*sortes Virgilianæ*). All the ancient Asiatic tribes had modes of divination; and sorcerers are common among the Indians of America. Many of the old forms of divination continue to be practised in Christian nations at the present day, sometimes from superstition, sometimes for amusement, gypsy fortune-tellers being often resorted to. There are many names for the different modes of prognosticating the future by means of the various appearances which nature and art present, from the revolutions of the stars down to the grounds of a coffee-cup. The following by no means exhaust the list, as the different modes of divination that have been practised are almost endless: *Æromancy*, divination by air; *aleuromancy*, by flour; *arithmomancy*, by numbers; *bibliomancy*, by the Bible; *capnomancy*, by smoke; *catoptrromancy*, by mirrors; *cheiromancy*, by the palm; *cleidomancy*, by keys; *ciromancy*, by wax; *geomancy*, by the earth; *hepatoscopy*, by the liver of animals; *hydromancy*, by water; *lampadomancy*, by lamps; *necromancy*, by corpses; *nephelomancy*, by clouds; *oneiromancy*, by dreams; *pyromancy*, by fire; *rhabdomancy*, by rods. The works on this subject are very numerous, including the mystical productions of the East, the Cabala (q.v.), the treatises on astrology, witchcraft, etc., in the Middle Ages, and the studies of more recent writers. See ASTROLOGY; BLACK ART; CUP, DIVINATION BY; CLAIRVOYANCE; ORACLE; PALMISTRY; WITCHCRAFT.

**Bibliography.** — Bouché Leclercq, 'Histoire de la divination dans l'antiquité'; Cicero, 'De Divinatione'; Ennemoser, 'History of Magic'; Jung-Stilling, 'Theorie der Geisterkunde'; Schneider, 'De Divinationum Origine et Progressu.'

**Divine Right**, the doctrine that the right of sovereigns to rule is derived immediately from the Deity, whose representatives they are, and that accordingly they are not responsible to their subjects for their method of governing, nor to any other human court of appeal. This was the doctrine to which the Stuarts were so much attached, and which was taught almost universally by the clergy of the Church of England and in the universities after the Restoration.

## DIVING—DIVISIBILITY

Even the tyranny of James II. was not enough to induce the English clergy to renounce this favorite doctrine, and after the revolution about 400 of them, including some of the bishops, sacrificed their benefices rather than forsake their principles in the matter. After this time the theory of divine right and passive obedience was little more heard of in England.

**Diving**, plunging into water and remaining submerged for greater or less periods of time, with or without communication with the atmospheric air. Diving without the aid of some artificial means to supply the diver with air under water is now rarely practised (unless for amusement) except in sponge, coral, and pearl fishing; and sometimes for recovering treasure from wrecked vessels. The best divers are able to remain about one minute and a third under water, and only in extreme and exceptional cases as long as two minutes. Instances are recorded of divers remaining four, five, and even six minutes under water, but these are of questionable authenticity.

To enable divers to remain for a considerable time (sometimes five or six hours) under water a diving dress has been used, which is so contrived that the diver is constantly supplied with air from above. It consists of a waterproof dress, to which is attached a neck-piece or breast-plate fitted with a segmental screw bayonet joint to which the head-piece or helmet, the neck of which has a corresponding screw, can be attached or removed by one eighth of a turn. Air is supplied by means of a flexible tube, which enters the helmet and communicates with an air-pump. To allow of the escape of the used air there is another flexible tube which is led from the back part of the helmet to the surface of the water. There is a signal line attached to the diving dress, by which the diver communicates with the attendants, and he carries another line in his hand to guide him in returning to the rope or ladder by which he descends.

The diving apparatus now in use makes the diver independent of any connection with persons above the water. A strong metallic air reservoir of steel is carried on the diver's back. A respiratory tube issues from the chamber, and is terminated by a mouth-piece which is held between his lips and teeth. This tube is furnished with a valve which permits the expulsion of air, but opposes the entrance of water. When the diver wishes to leave the water he inflates his dress with air from his reservoir and immediately rises to the surface.

**Diving-bell**, a device by which work may be carried on under water with a full supply of atmospheric air. To illustrate the principle of this machine take a glass tumbler, plunge it into water with the mouth perpendicularly downward; it will be found that very little water will rise into the tumbler, but as air is compressible, it could not entirely exclude the water, which by its pressure condensed the air a little.

The first diving-bell we read of in Europe was tried at Cadiz by two Greeks in the presence of the Emperor Charles V. The first of any note was made by Dr. Halley. The diving-bell is most commonly made in the form of a truncated cone, the smaller end being closed and the larger one open. It is so suspended that it may sink full of air, with its open

base downward. As a diving-bell of the ordinary construction is open to the objection of not being easily moved about, an ingenious kind of diving-bell, called a *nautilus*, has been invented, which is not open to this objection, but which is entirely at the command of the occupants, who can make it sink or swim, and move it about at pleasure, and can use it at the same time to raise great weights and convey them to any desired spot. See **DIVING**; **NAUTILUS**.

**Divining Rod**, a forked rod or branch, generally but not necessarily of hazel, by means of which, according to a popular belief not yet wholly extinct, the presence of water, minerals, etc., underground, can be detected. When used, the rod, which is carried slowly along in suspension, will, as is affirmed, dip and point toward the ground when brought over the spot where the concealed water or mineral is to be found.

**Divisibility**, the capability of being separated into parts. A metaphysical problem, long discussed by philosophers on abstract principles, is the divisibility of matter. The microscope reveals only to an infinitely small extent the subdivision of substances and tissues, organic and inorganic. Even in the mechanical productions of art distinctness of subdivision is amazing. A slip of ivory, of an inch in length, has frequently a hundred equal parts marked on it, all being distinctly visible. Nobert, a Pomeranian optical instrument maker, is renowned for producing the finest rulings on glass which have hitherto been executed. These test-plates, as they are called, contain a number of bands, the coarsest of which in his 20-band plate contains 11,259 spaces to the inch, and the finest, 225,187. Yarn has been spun so fine that one pound of it extended 4,770 miles.

The gold-beaters begin with a ribbon an inch broad and 150 inches long, which has been reduced by passing through rollers, to about the 800th part of an inch in thickness. This ribbon is cut into squares, which are disposed between leaves of vellum, and beat by a heavy hammer till they acquire a breadth of more than three inches, and are therefore extended 10 times. These are again quartered, and placed between the folds of gold-beaters' skin, and stretched out, by the operation of a lighter hammer, to the breadth of five inches. There seems almost no limit to the gold-beater's skill in dividing his tissue of gold, for one grain of gold has been beaten out to a surface of 52 square inches, and leaves have been made 367,500 of which would go to the inch. Iron, the least malleable of the above-mentioned metals, has been reduced to wonderfully thin sheets. Fine tissue paper is about the 1,200th part of an inch in thickness, but at the exhibition of 1851, Gillott, the steel penmaker, exhibited rolled sheets of iron the 1,800th part of an inch in thickness. Since then a sheet has been produced with an area of 55 inches, weighing but 20 grains, and having a thickness of 1-4800th part of an inch.

It has been asserted that wires of pure gold can be drawn of only the 4,000th part of an inch in diameter. But Dr. Wollaston, by an ingenious invention, obtained wires of platinum much finer than this, some of them only the 30,000th part of an inch in diameter. Such excessive fineness is hardly surpassed by the filamentous produc-



## DIVISION—DIVORCE

tions of nature. Human hair varies in thickness from the 250th to the 600th part of an inch. The fibre of the coarsest wool is about the 500th part of an inch in diameter, and that of the finest only the 1,500th part. The silk line, as spun by the worm, is about the 5,000th part of an inch thick; but a spider's line is perhaps six times finer, or only the 30,000th part of an inch in diameter; insomuch that a single pound of this attenuated substance might be sufficient to encompass our globe. A single grain of sulphate of copper will communicate a fine azure tint to five gallons of water. Odors are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of 20 years. Some germs are almost inconceivably minute. Thus the germ known as *micrococcus* is a minute spherical body sometimes no greater in diameter than the 32,000th of an inch. The minute organisms to which the name of *bacteria* is specially applied are rod-shaped bodies about 1,000th of an inch in length. Many of the so-called infusorial animalcules are so exceedingly small that myriads of them may exist in a drop of water.

**Division**, in mathematics, the dividing of a number so as to discover how many times a lesser number is contained in it; one of the four fundamental rules of arithmetic. The number to be divided is the dividend, the number which divides is the divisor, and the result of the division is the quotient. Division is the converse of multiplication.

In military matters the section of an army consisting of two or more brigades, composed of the various arms of the service, and commanded by a general officer. In the navy, a select number of ships in a fleet or squadron of men-of-war. In deliberative legislation the mode of determining a question at the end of a debate. In the House of Representatives at Washington, a division has no traditional formalities, being determined by the rules of the body itself. In the Senate, a division is accomplished by a roll call. In the British House of Commons the speaker puts the question, and declares whether in his opinion the "ayes" or the "noes" have it. Should his opinion not be acquiesced in by the minority, the house is cleared, and the "ayes" directed to go into the right lobby and the "noes" into the left, where they are counted by two tellers appointed for each party. In the House of Lords the two sides in a division are called "contents" and "not-contents."

**Division of Labor**, in economics, a theory based on the principle that industry can be best carried on when each man has a special work to do. Constant practice in doing the same thing leads to a perfection which could not otherwise be attained. The classical illustration of it in the history of political economy is that of pin-making as given by Adam Smith: "One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten the pin is another; it is even a trade by itself to put them into a paper; and the important business of making a pin is in this manner divided into above 18 distinct operations, which in some manufactories are all performed by distinct hands." In this way 10 men could make

about 48,000 pins in a day, whereas, if they worked separately and independently, they certainly could not each of them have made 20, perhaps not one pin in a day. Adam Smith offers the following reasons why the division of labor secures greater efficiency: "First, the increase of dexterity in every particular workman; secondly, the saving of the time which is commonly lost in passing from one species of work to another; and lastly, the invention of a great number of machines which facilitate and abridge labor, and enable one man to do the work of many." Economists believe, however, that Smith has laid too great stress on both the second and third of the above reasons.

In biology, a conception borrowed from economics and introduced into biology by Milne-Edwards to describe the difference of function exhibited by the individual members of an animal colony, or by the different organs, tissues, and cells of a single organism. The figure of a hydroid colony, *Hydractinia*, shows how members, primarily and fundamentally the same in structure, become set apart as nutritive, reproductive, sensitive, and protective. The same division of labor or predominance of special functions in different individuals is beautifully illustrated in the *Siphonophora*.

**Diviti'acus**, chief of the Ædui, often mentioned in the 'Commentaries of Cæsar.' He was a constant adherent of the Romans, and on one occasion made a visit to Rome, where he became the guest of Cicero, who mentions him in his book, 'De Divinatione,' as belonging to the order of the Druids, and professing much knowledge of the mysteries of nature and the art of divination.

**Divorce**, the disruption, by the act of law, of the conjugal tie made by a competent court on due cause shown. In the United States, jurisdiction in divorce cases is usually conferred on the law courts by the statutes in the different States. The causes of divorce enumerated in these statutes are by no means uniform in relation to the various States, and are more numerous in many of the western States than in the eastern. In most of the States divorce may be granted on any of the following grounds: adultery, conviction of felony, cruel and inhuman treatment, wilful desertion for periods varying from one to three years, habitual drunkenness, impotency, or neglect to support the wife. In New York adultery is the only cause of absolute divorce. In South Carolina the courts have no power to grant divorce, strictly speaking, the legislature being the only authority for that purpose. In both of these States, as in others, the courts may declare an alleged marriage invalid on grounds which rendered the parties or either of them incapable of contracting it, such as idiocy, lunacy, former husband or wife living, etc. Separation from bed and board, commonly called limited divorce, is granted on the ground of cruel and inhuman treatment; or desertion and refusal to support by the husband may be a ground for a decree setting the wife free from the interference and control of her husband, though it may not sunder the marriage tie.

A person applying for a divorce will not be allowed to obtain judgment should it appear that he or she has been guilty of the same offense, or that there is collusion between the persons concerned in order to procure a divorce; for

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the same reason the plaintiff is always required to prove the existence of the grounds of divorce by satisfactory evidence, even though no contest is made on the other side. Parties also who have condoned the offense, that is, who, after it has been discovered, have consented again to live as husband and wife, are not allowed to obtain a divorce, but a second act of the same nature revives the right of action on the original offense.

The want of harmony in the legislation of the different States on this subject has led to very great confusion and conflict in regard to the rights and liabilities growing out of divorce against non-residents of the State where granted, and some uniform system of laws on the subject is greatly needed. As the jurisdiction of Congress over the subject is doubtful, uniformity can apparently be secured only by an amendment to the Constitution of the United States, or by the concurrent action of the various State legislatures.

By a late report made to Congress by Carroll D. Wright, commissioner of labor, on the subject of marriage and divorce, it appears that the whole number of divorces granted in the United States for a period of 20 years, commencing with 1867, was 328,716, of which 36,072 were granted in Illinois, 25,193 in Indiana, 15,355 in New York, 8,542 in Connecticut, 2,642 in New Jersey, and 163 in South Carolina. The ratio of marriages to one divorce for the same period was lowest in Rhode Island, being 11.11 marriages to each divorce. The cause for which the greatest number of divorces were granted was desertion, divorces on this ground numbering 126,557, or over 38 per cent of the whole number of divorces granted.

The differences in the divorce laws in the States account somewhat for the differences in the number of divorces granted in certain States. A large number of the divorces granted in some of the western States, where high divorce rates prevail, have been obtained by persons residents of other States before the statutory limit of time necessary for a residence in a State, which must elapse before beginning proceedings for a divorce. There are more divorces, in proportion to the population, granted in the United States than in Europe. The number of divorce courts in the United States will account in a great measure for this difference; about each county court, except in New Mexico, New Jersey, and South Carolina, or about 2,921 courts, have the power of granting divorces. There is but one divorce court in England, 28 in Germany, and 79 in France. Canada has few applications for divorce. In the 21 years ending with 1888, 94 divorces had been granted in Nova Scotia and New Brunswick together, and 41 in all the rest of the Dominion of Canada.

In England, the divorce court is composed of a judge ordinary, the three chiefs in the courts of common law, and three puisne judges. It is provided that either spouse may obtain a divorce on the ground of adultery, but in case the wife is petitioner the adultery must be accompanied by cruelty or desertion. By another act the power to pronounce a decree of divorce, which was at first reposed in the whole court, is given to the judge ordinary sitting alone; but in this case the decree so pronounced is a decree *nisi* and cannot become final for at least six months. After a decree of divorce the offending person is free to marry again, even with the paramour.

But it is also enacted that no clergyman shall be compelled to solemnize the marriage of any person who has been divorced. He must, however, allow another clergyman, if willing to do so, to perform the marriage. The same general rules as to collusion, condonation, the conduct of the parties, etc., which obtain in the United States are law also in England. In order to guard against fraud by parties conniving to procure a divorce, power is given to the queen's proctor to interpose, in case he has reasonable grounds to suspect collusion or recrimination, in order to oppose a petition for divorce. By these acts parties are also entitled to obtain a judicial separation on the ground of adultery, cruelty, or desertion. Judicial separation is declared to be in place of a separation "a mensa et thoro." A married woman, having obtained decree of judicial separation, is declared to be in all respects as a "femme sole" in regard to any property that she has or may acquire. Even before obtaining a separation a woman deserted by her husband may obtain from the court a protection for any property that she has or may acquire by her own industry.

In France there has been great opposition to any laxity in the divorce laws, but since the year 1884 French law has recognized three grounds of divorce: (1) adultery; (2) outrage, cruelty, or previous injury; (3) conviction of an infamous crime. These causes of action are equally available to husband or wife; but it is provided that the wife shall not marry again till after the expiration of 10 months from the date of the dissolution of the previous marriage. It is further provided that, in cases where divorce is sought on the ground of outrage, cruelty, or grievous injury, immediate divorce shall not be granted, but the parties may be granted separation for a year, with due provision for the wife's support during that time, at the end of which a final divorce may be granted if they have not been reunited in the meantime. Substantially the same rules as to condonation prevail as in the United States. All the proceedings necessary in such cases are carefully provided for by the code civil, as well as the consequences to the parties personal or proprietary.

In Germany, the question of divorce gave rise to a long contest. The General Prussian Code permitted divorce on the ground of mutual consent and deep-seated aversion, but on account of the newly-awakened religious life in the 19th century there was a strong opposition; this under Friedrich Wilhelm IV. arose to an overwhelming power. Many attempts were made to establish the laws of divorce on other bases, but on account of the personal antagonism of Friedrich Wilhelm IV. they remained without result. The demand for a biblical ground of divorce was fulfilled by the state, because the Bible does not offer a genuinely comprehensive ground of separation. It was considered that the Prussian law of divorce was lax and capricious and there was a unanimous demand for a more strenuous law in the interest of morals. This demand found recognition even in circles which were most opposed to ecclesiastical influence in politics. The opposing elements were reconciled by the personal influence of Wilhelm IV.; nevertheless the attempts of the legislatures to make a new regulation of divorce remained without results. At the present time attempts are being made for bringing about a common divorce law

## DIVORCE—DIX

for all of Germany. This proposed law rests theoretically on very strict principles which find justification in the motives. The Austrian code of common law allows to non-Catholic Christians separation from the bonds of matrimony on account of adultery, malicious desertion, five years' imprisonment, or on account of dangerous diseases, and repeated cruelty of treatment and invincible aversion.

Among the Jews: The enactment of the Mosaic law was the following: "When a man hath taken a wife, . . . and it come to pass that she find no favor in his eyes because he hath found some uncleanness in her, then let him write her a bill of divorcement, and give it in her hand and send her out of his house" (Deut. xxiv. 1). Here, it will be perceived, impurity is the only assigned cause for such divorce. The woman sent away might marry another man, but if he, too, divorced her, it was not permitted her first husband to take her again. The word "uncleanness" in the passage now quoted is a free translation: the Hebrew words mean literally "the nakedness of a thing." The exact import of this expression was sharply contested in the immediately pre-Christian times, the school of Hillel giving it a general meaning, and holding that a man might divorce his wife for the most trivial cause; while that of Shammai considered that the doubtful phrase signified adultery, for which therefore alone a man could put away his wife.

The Mohammedan law of divorce, founded on some passages in the Koran, allows of a separation by mutual consent, giving the wife the right of retaining her marriage portion, unless she agrees to relinquish a part of it as the price of the separation. The parties are permitted to separate and re-unite twice, if they can so agree without any particular conditions; but after the third divorce the husband is not permitted to receive his wife again until she shall have previously married another husband. The act of divorce is a judicial proceeding before the *cadi*, who does not decree it until three months after the application.

The Hindu and Chinese laws of divorce show little regard for women, and not only the causes recognized in European and American countries, but others are deemed sufficient for a husband to discard his wife.

The different Grecian states had each their respective laws of divorce. At Sparta they do not seem to have greatly regarded the delicacy of the marriage bed when the interest of the republic was in question; but divorces appear to have been rare, since the *ephori* fined Lysander for repudiating his wife. At Athens either the husband or wife might procure a divorce by exhibiting a bill for this purpose to the archon, and obtaining the verdict or consent of a jury to whom the question was referred. But the party applying must, it seems, have made application personally; and Alcibiades, according to Plutarch, took advantage of his authority as a husband to prevent his wife from making the application personally; for when she was going from her brother's house, where she had taken refuge, to the archon's to sue for a divorce, he forcibly seized upon her, and confined her to his own house.

The early laws of Rome permitted the husband to divorce his wife for poisoning his children, counterfeiting his keys, or adultery. But

other causes were afterward added; for the first divorce recorded was for the sterility of the wife. This was by Sp. Carrilius Ruga, about 230 B.C. Divorces afterward became very frequent, and a law was, on this account, made by Augustus, requiring additional ceremonies in a divorce; among other things, the presence of seven witnesses to the act of dissolution of the marriage. By the Theodosian code the husband could divorce the wife for adultery, or if she was a witch or a murderess, had sold a free-born person into slavery, violated a sepulchre, committed sacrilege, been accessory to theft or robbery, was given to feasting with strangers without the knowledge or against the wishes of the husband, lodged abroad without good reason, or frequented theatres and shows, her husband forbidding, or was aiding and abetting in plots against the state, or dealt falsely, or offered blows. The wife had equivalent rights in this respect, for she could procure a divorce on similar charges against her husband. He could be re-married immediately; she, not within a year.

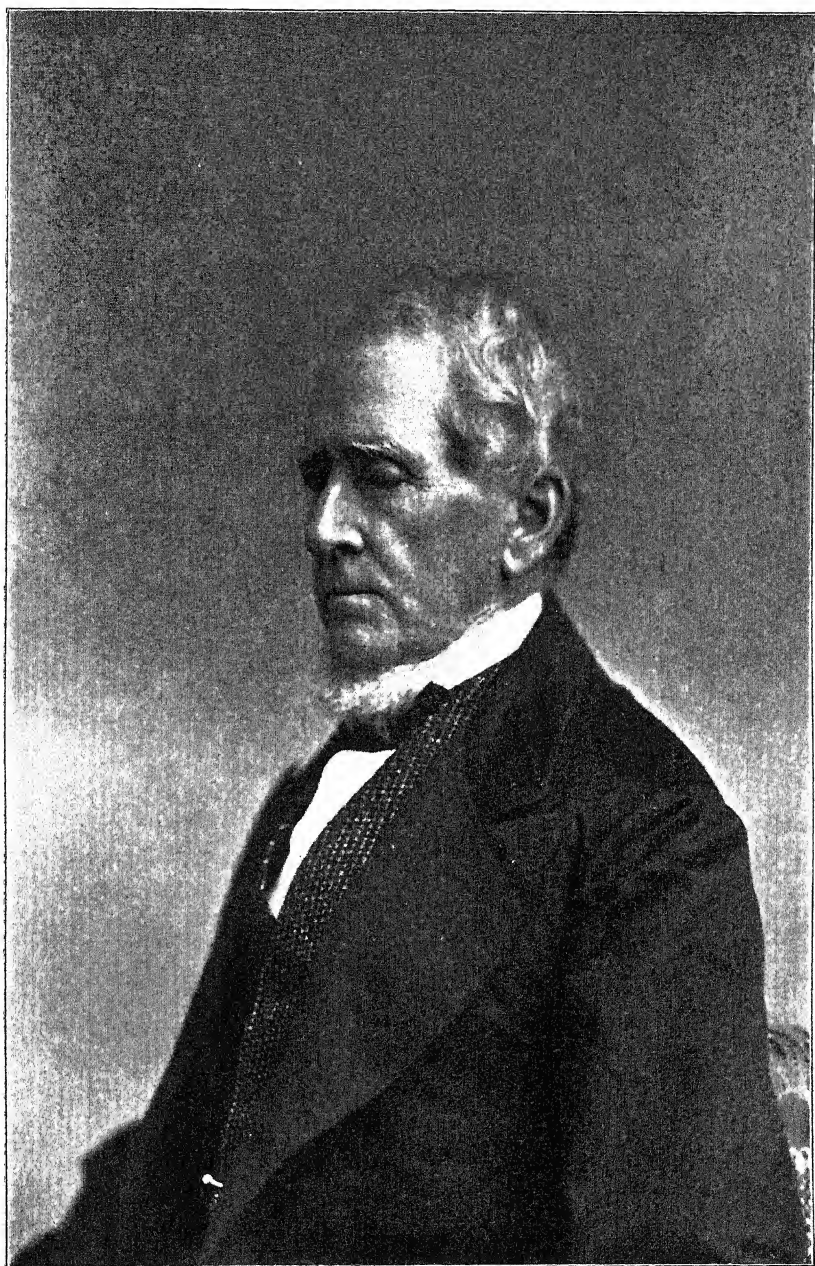
The facility of divorce continued, without restriction, under the Roman emperors, but as the modern nations of Europe emerged from the ruins of the Roman empire, they adopted the doctrine of the New Testament (Matt. xix. 6), "What God hath joined together, let not man put asunder."

Divorce, under the laws of the Roman Catholic Church is never allowed where the marriage has been duly contracted, ratified, and consummated. But a perfectly valid marriage contracted between baptized persons can be annulled by the Pope, before its consummation, never after consummation. It is held by canonists that a marriage lawfully and validly contracted but not consummated is annulled by either of the parties taking solemn life-time vows of continence and entering a religious order. If of two unbaptized persons, married, one is converted to the faith and receives baptism, he or she may be released from the marriage bond if the other party refuse to live peaceably and without insult to the Christian religion in the marriage state; and then the released party can marry again. Outside of such conditions as have been stated Christians united in marriage cannot in the Roman Catholic Church be freed from the marriage bond, *vinculum matrimonii*, save after the death of one or other of them. See MARRIAGE AND DIVORCE.

**Divorce, Court of.** See COURT.

**Dix, Beulah Marie**, American novelist: b. Massachusetts 1876. She has published: 'Hugh Gwyeth' (1899); 'Soldier Rigdale' (1899); 'The Making of Christopher Ferringham' (1901); 'The Beau's Comedy' (with C. A. Harper, 1902); 'A Little Captive Lad' (1902); 'Blount of Breckenhow' (1903).

**Dix, Dorothea Lynde**, American philanthropist: b. Hampton, Maine, 4 April 1802; d. Trenton, N. J., 19 July 1887. In her youth she supported herself by teaching in Worcester, Mass., but in 1830 fell heir to some property, after which she devoted her life to the relief and betterment of lunatics, paupers, and criminals. She visited the prisons, asylums, and almshouses of nearly every State in the Union, and by her efforts contributed largely to the establishment of lunatic asylums in those States which had none. She also traveled extensively in Eu-



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rope in the same service and her efforts materially improved the condition of the insane there, likewise. She published several children's books, and in 1845 'Prisons and Prison Discipline.' In 1903 a bill was favorably received in Congress appropriating \$10,000 for a monument to her at her birthplace. The report of the House Committee declares: "Miss Dix occupies a conspicuous place in history as a philanthropist. Certainly no other woman in modern times has done more to earn the gratitude of the people of this country than this self-sacrificing and devoted woman. Her services during the Civil War as chief of the hospital nurses of the United States and her wonderful success in establishing institutions for the insane—over 30 in number—in the South and West and elsewhere in the country, place her among the noblest examples of humanity in all history." Consult Tiffany, 'Life of Dorothea Lynde Dix' (1890).

**Dix, Edwin Asa**, American author: b. Newark, N. J., 25 June 1860. He was graduated from Princeton University in 1881; studied law at Columbia College Law School; and was admitted to the bar in 1884. He served as literary editor of 'The Churchman' for a time, and is the author of 'A Midsummer Drive Through the Pyrenees'; 'Deacon Bradbury'; a novel; and many short stories, sketches, and travels.

**Dix, John Adams**, American statesman and soldier: b. Boscawen, N. H., 24 July 1798; d. New York 21 April 1879. In 1812 he was appointed a cadet in the United States army, and in 1813, ensign. He took part in the operations on the Canadian frontier during the War of 1812; afterward studied law and was admitted to the bar in Washington. In 1826 he was sent as a special messenger to the court of Denmark. He resigned from the army in 1828, and began practising law in Cooperstown, N. Y. Later he was secretary of state and adjutant-general of New York, and was prominently associated with the "Albany Regency," the controlling power of the Democratic party. In 1841 he was elected to the State assembly, and in 1845-9 was a United States senator. In 1861 he was appointed secretary of the treasury by President Buchanan. At this time there were two revenue cutters at New Orleans, and he ordered them to New York. The captain of one refused to obey his order, and Dix telegraphed to put him under arrest, adding the statement which has made him famous, "If any one attempts to haul down the American flag, shoot him on the spot." At the outbreak of the Civil War, he was elected president of the Union Defense Committee, and organized 17 regiments. He was commissioned a major-general of volunteers, and through his active measures saved Maryland to the Union cause. He was elected governor of New York in 1872, but was defeated on a renomination in 1874.

**Dix, Morgan**, American Episcopal clergyman: b. New York 1 Nov. 1827. He is a son of J. A. Dix (q.v.). He was graduated from Columbia College in 1848 and from the General Theological Seminary in 1852. He then took orders in the Episcopal Church and after serving for a few years as assistant in Trinity Church, New York, became in 1862 the rector of Trinity parish. In November 1902 the 40th anniversary of his rectorship was celebrated. To the

rector of the leading Episcopal church in New York there ever presents itself a great opportunity, and of this opportunity Dr. Morgan Dix has made the best use. Under his wise guidance he has seen Trinity grow in size and power, until to-day the power wielded by its rector is second only to that of the bishop. It has been said of him that "he nominates his own assistants independently of the bishop of the diocese" and that "he presides directly over one ninth of the entire diocese and one fifth of the Episcopalians in Manhattan." Prior to 1901 he had been president of the House of Clerical and Lay Deputies in many successive general conventions of the Episcopal Church. He has published: 'Commentary on the Epistle to the Romans' (1864); 'Exposition of the Epistles to the Galatians and Colossians' (1865); 'Lectures on the Pantheistic Idea of an Impersonal Substance Deity' (1865); 'Lectures on the Two Estates' (1872); 'Memoirs of John A. Dix' (1883); 'The Sacramental System' (1893); 'History of the Parish of Trinity Church' (1899-1901).

**Dixey, Henry E.**, American actor: b. Boston, Mass., 6 Jan. 1859. His earliest success was in the comedy of 'Adonis,' in which he assumed the title role, and he has since played many comic parts.

**Dixie, Lady Florence Caroline Douglas**, English explorer and writer: b. London 24 May 1857. She explored Patagonia 1878-9, was war correspondent for the London *Morning Post* in the Boer war 1880-1, and was instrumental in securing the liberty of Cetawayo, king of Zululand. She has published: 'The Songs of a Child and Other Poems'; 'Across Patagonia'; 'In the Land of Misfortune'; 'A Defence of Zululand and Its King'; 'The Child Hunters of Patagonia'; 'Aniwee or the Warrior Queen'; 'Gloriana'; 'Redeemed in Blood'; 'Little Cherie'; 'Ijain, or the Evolution of a Mind'; 'Isola,' a drama; 'Two Castaways'; etc.

**Dixie**, a name associated in negro minstrelsy with the Southern States. It is supposed to be derived from the name of one Dixie, a large-holding and kind-hearted slave-owner on Manhattan Island in the latter part of the 18th century. His treatment of his negroes caused them to regard his plantation (or "Dixie's") as little short of an earthly paradise, and when any of the slaves were taken away from home they always pined for "Dixie's," while singing and talking of its joys. When slavery moved southward in search of a more secure and congenial habitat, the same ideal of "Dixie's" was taken along, and the chant which the former slaves of Dixie sang of their old home became so widespread that its origin was lost sight of and it came to be applied to the southern homes of the negroes.

In fact in the South "Dixie" is held to mean the Southern States, the word being regarded as a derivation and corruption of "Mason and Dixon's line," (q.v.) which originally divided the free and slave States, and supposed by the Southerners to have first come into use when Texas joined the Union and the negroes frequently sang of it as "Dixie."

**Dixon, Charles**, English naturalist: b. London, England, 20 July 1858. His entire life has been devoted to natural history study, bird migration and the geographical distribution of species having been his especial field. His pub-



lished books include 'Rural Bird Life' (1880); 'Evolution without Natural Selection' (1885); 'Our Rarer Birds' (1888); 'Stray Feathers from Many Birds' (1890); 'Annals of Bird Life' (1890); 'Idle Hours with Nature' (1891); 'The Birds of Our Rambles' (1891); 'The Migration of Birds' (1892); 'Jottings About Birds' (1893); 'Game Birds and Wild Fowl of the British Islands' (1893); 'Nests and Eggs of British Birds' (1893); 'Nests and Eggs of Non-indigenous British Birds' (1894); 'The Migration of British Birds' (1895); 'British Sea Birds' (1896); 'Curiosities of Bird Life' (1897); 'Our Favorite Song Birds' (1897); 'Lost and Vanishing Birds' (1898); 'Bird Life in a Southern Country' (1899); 'Among the Birds in Northern Shires' (1900); 'The Story of the Birds' (1900); 'Birds' Nests' (1902); 'A Popular History of Birds' (1902).

**Dixon, Frank Haigh**, American educator: b. Winona, Minn., 8 Oct. 1869. He was graduated at the University of Michigan 1892, and has been assistant professor of economics in Dartmouth College since 1898, and secretary of the Amos Tuck School of Administration and Finance since 1900. He has published 'State Railroad Control.'

**Dixon, James**, American lawyer and statesman: b. Enfield, Conn., 5 Aug. 1814; d. Hartford, Conn., 27 March 1873. He was graduated at Williams College, and achieved distinction in the practice of the law, but turning his attention to public affairs, was repeatedly elected to the Connecticut legislature as a Whig, served two terms in the United States House of Representatives, and was a member of the United States Senate from 1857 to 1869.

**Dixon, James Main**, American educator: b. Paisley, Scotland, 20 April 1856. He was educated at the University of St. Andrews, was professor of English in the Imperial College of Engineering, Japan, 1879-86; professor of English in the Imperial University of Japan 1886-92, and professor of English literature in Washington University 1892-1901. He has published 'A Dictionary of Idiomatic English Phrases' (1891), and is joint author of an 'Illustrated History of Methodism' (1900).

**Dixon, Joseph**, American inventor: b. 1799; d. 1869. He was at various times shoemaker, printer, wood engraver, and physician, and establishing crucible works in 1827 at Salem, Mass., became very wealthy. In the course of his experiments he devised important improvements in philography, smelting, bank-note printing, etc.

**Dixon, Richard Watson**, English clergyman and author: b. London 1833; d. 2 Jan. 1900. He was educated at Oxford; was master in the high school at Carlisle in 1863, and canon of Carlisle in 1874. He became vicar of Hayton in 1873 and of Warkworth in 1883. He published: 'Christ's Company and other Poems' (1861); 'Historical Odes and other Poems' (1864); 'Mano, a Poetical History' (1883); 'Odes and Eclogues' (1884); 'Lyrical Poems' (1885); 'The Story of Eudocia and Her Brothers, a Narrative Poem' (1887); 'Songs and Odes' (1896); 'Essay on the Maintenance of the Church of England' (1875); 'Life of James Dixon' (1874); and 'History of the Church of England from the Abolition

of the Roman Jurisdiction' (1880-1900). He was associated with Burne-Jones, Rossetti, and Morris, in founding the 'Oxford and Cambridge Magazine,' the chief organ of the pre-Raphaelite school.

**Dixon, Thomas, Jr.**, American novelist and clergyman: b. Shelby, N. C., 11 Jan. 1864. He was graduated at Wake Forest College, N. C., 1883, and Greensboro, N. C., law school 1886, and admitted to the bar in the last-named year. After serving from 1884-86 as member of the legislature in North Carolina he resigned to enter the Baptist ministry. He was pastor in Raleigh, N. C., 1887; Boston, Mass., 1888-9, and New York 1889-99. Among his works are: 'Living Problems in Religion and Social Science' (1891); 'What is Religion?' (1892); 'Sermons on Ingersoll' (1894); 'The Leopard's Spots' (1902); 'The One Woman' (1903).

**Dixon, William Hepworth**, English author: b. Manchester 30 June 1821; d. London 27 Dec. 1879. In 1849 he published a memoir of Howard the philanthropist, followed by the 'Life of William Penn' (1851), and by a work on Admiral Blake (1852). In 1853 he became chief editor of the 'Athenæum,' a post which he retained till 1869. During this period he published several very popular works, including the 'Personal History of Lord Bacon,' 'The Holy Land,' and 'New America,' the last being followed by 'Spiritual Wives.' After his retirement from the 'Athenæum,' he wrote some 25 volumes of history, travel, and fiction, among others, 'Free Russia'; 'Her Majesty's Tower'; 'The Switzers'; 'History of Two Queens, Catharine of Aragon and Anne Boleyn'; 'Royal Windsor.'

**Dixon, William MacNeill**, English scholar: b. India 1866. He was educated at Trinity College, Dublin, and has been professor of English literature and language in the University of Birmingham from 1894. He has published: 'English Poetry from Blake to Browning'; 'A Tennyson Primer'; 'In the Republic of Letters'; 'History of Trinity College, Dublin.'

**Dixon, Ill.**, county-seat of Lee County, situated on the Rock River, about 65 miles above its junction with the Mississippi River, and on the Illinois C., and the Chicago & N. W. railroads. The manufactures of the city are agricultural implements, wagons, shoes, and condensed milk. It is the seat of one of the normal schools of Illinois. Pop. (1900) 7,917.

**Dixon Entrance**, a strait on the west coast of North America, separating Queen Charlotte Islands from the Prince of Wales Archipelago, and so dividing British territory from a part of Alaska.

**Dixwell, John**, English regicide: b. 1608; d. 18 March 1689. After the reaction in England which placed Charles II. upon the throne, and caused himself and his associates to be condemned to death, he escaped to America, changed his name, taking that of John Davids, and lived undiscovered among the inhabitants of New Haven, where he was married and left children. In 1664 he visited two of his fellow regicides, Whalley and Goffe, who had found a refuge amid the solitudes of Hadley, Massachusetts. His favorite study in exile was Raleigh's 'History of the World,' and he cherished a constant faith

that the spirit of liberty in England would produce a new revolution.

**Dizful**, dēz-fool', Persia, capital of the province of Khuzistan, about 190 miles west of Ispahan, on the river Diz. It has over 35 sacred tombs, and nearly as many mosques; but on account of the heat half the town consists of subterranean excavations in the rock. Pop. about 25,000.

**Djezzar**, jēz'zār ("butcher"), the name given to Achmed Pasha: b. Bosnia about 1735; d. Acre 1804. He was famous for his obstinate defense of Acre against Napoleon I. He rose, through murder and treason, from the condition of a slave to be Pasha of Acre. In the beginning of 1799 the French entered Syria from Egypt, and advanced from victory to victory till they reached Acre, which was laid siege to on 20 March. By advice of Sir Sidney Smith, Djezzar was induced to hold out; and such was the savage doggedness of his defense that Bonaparte was obliged to retire on 21 May.

**Djokdjokarta**, dyōk-dyō-kār'tā, or **Najoe-djiō-karto**, a residency on the island of Java, with a capital of the same name. Its only high mountain, the volcano Merapi, is 3,150 feet high. It has no large river. Its forests abound in djatti (teak) wood. It was once an independent kingdom, but it is now controlled by the Dutch. Pop. 441,800. The town is the seat of the native sultan and of a Dutch resident. Pop. 45,000.

**Dnieper**, nē'pēr (Russian, DNJEPR, dnyēp'-ēr; ancient BORYSTHENES), a river of Russia which rises in the government of Smolensk, flows south to Kiev, then southeast to Ekaterinoslaff, then south to Androosk, then southwest to the Black Sea. Below Ekaterinoslaff are the famous rapids through which boats must be guided by pilots, and which can be passed only at full tide. The Dnieper begins to be navigable a little above Smolensk. Its total length is 1,230 miles.

**Dniester**, nēs'tēr (Russian, DNJESTR, dnyēs'tēr; the ancient TYRAS; later DANASTRIS or DANASTUS), a large river of Europe, which has its source in a lake in the Carpathian Mountain, in Austrian Galicia, and flows into the Black Sea, between Ovidiopol and Ackerman. Its length is over 800 miles; and its course is mostly through Russia. Only when the water is very high can ships of small burden ascend as far as Bender.

**Doab**, doo'āb (Sanskrit, "Two Waters"), a name in Hindu applied indiscriminately to any tract of country between two rivers. The tract between the Ganges and the Jumna is usually called the Doab; other similar tracts have their distinctive name, as the Bari Doab, between the Bias and Ghara and the Ravi; the Rechna Doab, between the Ravi and the Chenab; and other places.

**Doak**, Samuel, American Presbyterian clergyman: b. Augusta County, Va., 1 Aug. 1749; d. Bethel, N. C., 12 Dec. 1830. He was graduated from Princeton; was for a time tutor in Hampton Sidney College; and was licensed to preach in 1777. He first settled at Holston, and later at Salem, Tenn., where he built a small church, formed the Salem congregation, and established a school, the first organized in the Mississippi valley. It was incorporated in 1785

as Martin Academy, and in 1795 became Washington College; Doak was its president from 1795 to 1818. He then removed to Bethel, where he founded Tusculum Academy.

**Doane**, George Hobart, American Roman Catholic clergyman: b. Boston, Mass., 5 Sept. 1830. He is a son of G. W. Doane (q.v.). He was graduated at Jefferson Medical College in 1850, became a deacon in the Protestant Episcopal Church, but later entered the Roman Catholic Church and was ordained priest in 1857. In 1873 he was made vicar-general of Newark, N. J., and in 1886 the Pope made him a domestic prelate with the title of Monsignore. He has written: 'First Principles'; 'Exclusion of Protestant Worship from Rome'; etc.

**Doane**, George Washington, American Episcopal bishop: b. Trenton, N. J., 27 May 1799; d. Burlington, N. J., 27 April 1859. He was educated at Union College, and was one of the first six students at the General Theological Seminary in New York. He was ordained deacon in 1821 and priest two years later, having become in the meantime an assistant in Trinity Parish, New York. Here he remained until 1825, when he was appointed professor of rhetoric and belles-lettres in Washington (now Trinity) College, Hartford. This position he held for three years, going then to Boston as assistant and afterward rector of Trinity Church. In 1832 he was consecrated bishop of New Jersey, and took up his residence in Burlington, N. J., combining the rectorship of St. Mary's Church with the episcopate until his death. Besides a vigorous prosecution of general religious work in his diocese, he devoted himself especially to the promotion of Christian education, in which he was a firm believer. In 1837 he founded St. Mary's Hall, a boarding\* and day school for girls, at Burlington, and in 1846 organized Burlington College in the same town. His zeal in this direction, combined with incomplete knowledge of business principles, led to financial embarrassment and ultimately to presentment for trial before his brother bishops; but the charge was unanimously dismissed. In many ways Bishop Doane was far in advance of his time, advocating daily services and the free church system when they were practically unknown in America. He left a large number of published sermons, lectures, and essays, and was also a poet of no mean ability, his best-known poem being that beginning 'What is That, Mother?'

**Doane**, William Crosswell, American Protestant Episcopal bishop: b. Boston 2 March 1832. He is a son of G. W. Doane (q.v.). He was ordained deacon (1853) and priest (1856) in St. Mary's Church, Burlington, N. J., serving as assistant there until the latter date, when he took charge of St. Barnabas' Church, Burlington. He succeeded his father in the rectorship of St. Mary's (1859-61), and after holding rectorships at Hartford, Conn. (1861-7), and Albany (1867-9), became in the year last named the first bishop of Albany, on the division of the large diocese of New York. In this position he has acquired a reputation as a wise and statesmanlike administrator, and has been a diligent promoter of religious education. St. Agnes' School at Albany was founded by him. He took a prominent part in the second, third,

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and fourth Lambeth Conferences, and in the discussions on the revision of the American prayer-book, to which his liturgical knowledge made valuable contributions. He is known as a firm believer in the cathedral system, and has spent much labor on its organization at Albany, including the erection of a magnificent cathedral. His most important literary work is his 'Life of Bishop George Washington Doane' (1860). He has published also: 'Mosaics, or the Harmony of the Collects, Epistles, and Gospels'; 'A Catechism of the Christian Year'; 'The Manifestations of the Risen Lord.'

**Doane, William Howard**, American composer: b. Preston, Conn., 3 Feb. 1831. He was chief editor of the Baptist 'Hymnal' and has composed numerous popular evangelistic hymns and songs. He has also published more than 20 collections of hymns and several cantatas. He early removed to Cincinnati where he has been president and general manager of a firm of manufacturers of wood-working machinery since 1861.

**Doane College**, in Crete (q.v.), Neb., a co-educational school, began its legal and corporate existence 11 July 1872. The college was the outgrowth of an academy organized in 1871, which virtually became the preparatory department of the college, which was named in honor of Thomas Doane, a generous benefactor. In 1893 the academy resumed its name, a principal was appointed, and special efforts were made to develop academic life. Doane College is the centre of a group of schools all under the auspices of the General Association of the Congregational Churches of Nebraska. The group is composed of four academies; one at Chadron, in Dawes County, in the northwest part of the State; another at Neligh, in Antelope County, in the northeast; one at Franklin, in Franklin County, in the south; the fourth at Weeping Water, in Cass County, in the east; with Doane College, the head, at Crete, in Saline County. The motto of the college is, "We build on Christ."

The government of the college is vested in a board of trustees, consisting of 27 members, who are self-perpetuating. Each member serves three years but is eligible for re-election. Each class of graduates from the college names one of its number as a candidate for membership to the board of trustees, and such name is put on the eligible list. Three of the trustees are representatives of the Nebraska Congregational Churches.

The college courses are classical, literary, and scientific; and the degrees granted are A.B., B.S., and B.L. There are departments of music and art. In 1903 there were connected with the school 17 professors, and about 200 students. Connected with the system there were 700 students. The library contained 9,038 bound volumes and 5,673 pamphlets. The college owns 600 acres of land, 90 acres of which are in the campus, and 50 acres have been made into a park. Aid is furnished worthy and needy students. The endowment fund is \$166,000, and the annual expenses are \$18,000. The college is free from debt.

**Dobbs Ferry**, N. Y., a residential village in Westchester County, on the Hudson River, and on the New York C. & H. R. Railroad, 25 miles north of the city hall, New York. It is an interesting town historically, having been the scene

of many important events in the Revolutionary War. The Yorktown campaign was planned in the Livingston house, and the first salute fired by a British war sloop to the American flag was given opposite this place. Pop. (1900) 2,888.

**Dobereiner, Johann Wolfgang**, yō hān vōlf'gāng de'bē-ri-ner, German chemist: b. Hof, Bavaria, 15 Dec. 1780; d. Jena 24 March 1849. He was professor of pharmacy and chemistry at Jena for 39 years, and discovered the combustibility of platinum, the apparatus for utilizing which is known as Dobereiner's lamp (q.v.). He published 'Zur Pneumatischen Chemie,' and other works. His correspondence with Goethe and Charles Augustus of Weimar appeared in 1856.

**Dobereiner's Lamp**, a contrivance for producing an instantaneous light, invented by Prof. Dobereiner, of Jena, in 1824. The light is produced by throwing a jet of hydrogen gas upon recently prepared spongy platinum, whereupon the metal instantly becomes red hot, and then sets fire to the gas. The action depends upon the readiness with which spongy platinum absorbs gases, more especially oxygen gas. The hydrogen is brought into such close contact with oxygen (derived from the atmosphere) in the pores of the platinum that chemical union, attended with evolution of light, takes place.

**Dobrizhoffer, dō'brīts-hōf-ēr, Martin**, a Jesuit missionary to the native tribes of Paraguay and author of a voluminous and celebrated memoir on the Abipones, a Paraguayan tribe: b. Gratz, Syria, 1717; d. Vienna 17 July 1791. At the age of 19 he entered the Jesuit order and in 1749, having been ordained priest, was assigned to the mission of Paraguay, in which he spent 18 years, returning then to Austria where he passed the remainder of his life, devoting his leisure to writing his memoir 'Historia de Abiponibus, etc.,' that is, 'A history of the Abipones, a cavalier and warlike people of Paraguay, enriched with copious observations on the barbarous natives, rivers, beasts, amphibia, insects, principal serpents, fishes, birds, trees, plants, and peculiarities of the said province.' A translation of the work (somewhat abridged) by Sara, S. T. Coleridge's daughter, was published in three large volumes (1822). Southey, in his 'Tale of Paraguay,' in complimenting Miss Coleridge upon the faithfulness of her translation of so voluminous a work, and one so full of difficulties for the translator, alludes to the Empress Maria Theresa's generous protection of the author after he and his order had been expelled by the Spanish government from South America and after the order had itself been suppressed by the Pope:

And if he could in Merlin's glass have seen  
By whom his tomes to speak our tongue were taught,  
The old man would have felt as pleased, I ween,  
As when he won the ear of that Great Empress Queen.

**Dobrovsky, dō'brōf-skē, Joseph**, Bohemian critic, historian, and philologist: b. Gyermet, Hungary, 17 Aug. 1753; d. Brünn 6 Jan. 1829. He was without a peer in Bohemian learning, ranking among the greatest philologists and critics with his 'History of the Bohemian Language and Literature' (1792); 'Principles of the Old Slavic Dialect' (1822); 'Grammar of the Bohemian Language,' and a wealth of simi-

lar works, all characterized by accuracy and sound judgment, and conferring unparalleled obligations on Bohemian letters.

**Dobrudja**, dō-brú'ja, or Dobrudscha, a territory forming part of the kingdom of Rumania, included between the Danube and the Black Sea. The principal town is Babadagh. Area, 6,102 square miles. Pop. 199,711.

**Dobschau**, dōb'show (Hungarian DOB-SINA), Hungary, town about 52 miles northwest of Miskolcz. Its industries comprise bee-culture, flax-growing, and the mining of copper, quicksilver, cobalt, nickel, and iron. It has a noted ice cavern. Pop. (1890) 4,643.

**Dobson, Henry Austin**, English poet: b. Plymouth 18 Jan. 1840. In 1856 he became a clerk in the Board of Trade, where he is now one of the officials known as principals. His earliest verses first appeared in the magazine called 'St. Paul's,' and were subsequently published in book form under the title 'Vignettes in Rhyme and Vers de Société' (1873). Since then he has published several other volumes of verse, including 'Proverbs in Porcelain' (1877); 'Old World Idylls' (1883); and 'At the Sign of the Lyre' (1885). Among his prose works may be mentioned his Lives of Fielding (1883); Steele (1886); Hogarth (1879); Goldsmith (1889); and Horace Walpole (1890); critical biography of William Hogarth (1891); 'Thomas Bewick and His Pupils' (1884); 'Four Frenchwomen' (1890); three series of 'Eighteenth Century Vignettes' (1892-6); 'A Paladin of Philanthropy' (1899); 'Sidewalk Studies' (1892). His collected poems were published in one volume in 1897. Many of his poems are written in various French forms, such as the rondeau and ballade, and all are marked by gracefulness, ease, and careful finish.

**Dobson, William**, English portrait painter: b. London 1610; d. Oxford 28 Oct. 1646. Having acquired considerable skill as a painter, he came under the notice of Van Dyck, who introduced him to Charles I. On the death of his patron he succeeded him as sergeant-painter to the king. Among his portraits are those of himself and his wife, Sir Charles Cotterell, Sir Thomas Browne's family, the first Duke of Newcastle, the Marquis of Montrose, Fairfax, and Old Parr; and in addition there are other pictures by him, the chief being 'The Beheading of St. John.'

**Doce**, dō'sā, a river of Brazil, rising by several streams on the eastern slopes of the Serra de Mantiqueira in the state of Minas Geraes, and flowing to the Atlantic, which it enters about 30 miles northeast of Santa Cruz. It is about 600 miles long, and is navigable up to 120 miles from its mouth.

**Docetæ**, dō-sē'tē, sectaries who held the human nature of Christ to be an illusion, phantasmal, and not real. The word is from the Greek verb *δοκέω*, to appear, to seem. The Docetæ were adherents of the Gnostic school and their peculiar dogma was held by a swarm of Oriental sects which preceded and outlived Arianism, both in the East and West. Their denial of the real humanity of Christ was made on the same ground on which Cerinthus (q.v.) denied that the universe is the creation of the principle of all good. That this view prevailed among sects in apostolic times is inferred from

a passage in the first epistle of St. John: "Every spirit which confesseth that Jesus Christ is come in the flesh is of God; and every spirit, which confesseth not Jesus is not of God."

**Dock**, a name applied to a large section of the genus *Rumex*, belonging to the buckwheat family (*Polygonaceæ*), chiefly those that are not acid. These are large perennial herbaceous plants, with stout roots, alternate, ovate, and often entire leaves, and bearing panicles of small greenish and usually perfect flowers in whorls. Their roots have an acrid taste, are astringent and styptic and are used in medicine. The root of the water-dock (*Rumex aquaticus*) makes a black color in a solution of sulphate of iron. This plant was greatly venerated by the Druids, who attributed to it miraculous qualities. Numerous species of this genus are known, some widely distributed over the northern hemisphere, 22 species being known in eastern and northern America.

**Dock Warrant**, a species of warehouse receipt given by a dock-owner to the owner of goods specified in dock warrant, and engaging to deliver them to owners or assignees. The Factor's Act in England has placed dock warrants on the same footing as bills of lading, and in many States of the American Union they have been declared negotiable by statute.

**Docket**, or **Docquet** (from "dock," to cut short, to abridge), in law, a term indifferently used for a summary of a larger writing; a small piece of paper or parchment containing the heads of a writing; an alphabetical list of cases in a court, or a catalogue of the names of the parties who have suits depending in a court.

**Docks and Dock Yards, in the United States.** Dock yards, dry docks, lift docks and marine railways are found on the Atlantic coast from Maine to Florida; on the Pacific from California to Washington; along the shores of the Great Lakes, and in the Philippines. On the Atlantic seaboard the most easterly harbor is Bath, Me., which has no dry docks, but a ship railway with a cradle 200 feet long. Extensive shipbuilding, however, is carried on in this city. The Bath Iron Works build and repair large hulls, engines and boilers, turn out shafts of any diameter up to 29 feet in length, and can make castings of 12 tons in weight. Besides the building of iron ships, wooden shipbuilding is carried on extensively at Bath, and most of the famed clipper ships that have made a name for American enterprise and commerce, and challenged the world in their fleet transit over the Atlantic, hailed from Bath, and to-day "Bath, Me.," is a very common inscription on the sterns of sailing ships.

Portland, at the head of an inlet, the largest city in Maine, has two wooden dry docks of the Simpson type; one being 415 feet long, with 23 feet of water over the sill, and a smaller one with a length of 200 feet. The Portland Company's Locomotive Works have large and heavy machinery suitable for repairing marine engines and hulls of vessels.

Near Portsmouth, N. H., the only seaport in the State, on Continental or Fernald's Island, is the Kittery Navy Yard. The famous U. S. S. Kearsarge was built at this station. Repairs of almost any extent can be made at this yard, and almost any kind of shipbuilding may be

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done except the very largest. As a part of the plant, the government is now building a large concrete dry dock, about 750 feet in length over all. This dock will have sufficient capacity to take the largest battleships and merchantmen. The government has in addition a floating dock of 5,300 tons capacity.

Proceeding south the next point of interest is Massachusetts Bay and Boston. At Charlestown, a suburb of Boston, is located the Navy Yard, well equipped for making extensive repairs and for building large engines and ships. Besides the old granite dry dock, built in 1827, the government has now under construction a concrete dock about 750 feet in length over all, with 30 feet of water on the sills. At East Boston is located the plant of the Atlantic Works, covering about 12 acres of land. The largest ship that can be built and launched from the ways of this company is one of 3,500 gross tonnage; to build such ships and overhaul and make extensive repairs, the yard is fitted with a modern plant. This company operates three marine railways, the largest having a capacity of 2,000 tons. The Simpson Patent Dry Dock Company own three dry docks, one of which is 465 feet over all, with 19 feet of water on sill. Near Boston is the city of Quincy, where is located the Fore River Engine Company, with a plant for large and extensive shipbuilding. This company can build the largest class of ships, and is equipped to make the heaviest forgings required in marine work, shafts up to 40 inches in diameter can be turned and bored, and, up to 55 feet in length, can be bored without turning end for end. Although construction work is their chief industry, some repair work is done, and the company is now contemplating the construction of a floating dry dock of the largest size.

At Bristol, R. I., are located the famous shipyards of the Herreshoff Manufacturing Company, where most of the yachts were designed and built which have so successfully defended the America's Cup. Besides yachts, small ships are built at this yard.

At New London, Conn., once famous as a port from which whalers and sealing crafts hailed, is the home of the Eastern Shipbuilding Company, which concern recently launched the S. S. Minnesota, and is now building the S. S. Dakota, which will be launched in the fall of 1903, two of the largest steamships ever built. They are destined to be used in the Oriental trade, and are to ply from Seattle, Wash., to Japan and China. This company has no dry dock at the present time, but are contemplating the construction of some docks of very large capacity. The Morgan Iron Works are also located at New London. Their plant is designed for large and extensive repairs, and the construction work done at this plant is principally engines and boilers. A naval station located at New London is of little importance in so far as construction or repairs are concerned.

Between New London and New York there are no harbors or works of importance to shipping interests. At New York one finds an outer and inner harbor.

On the easterly shore of the inner harbor, and on the East River, the government has established the largest navy yard in this country. A thoroughly efficient and modern shipbuilding plant forms part of the equipment, and large

ships can be built. The ill fated U. S. S. Maine was constructed at this yard. Three dry docks are now in commission, and a fourth one about 571 feet long is under consideration. The existing docks are: One granite dock 362.2 feet over all; one originally wood and recently reconstructed of concrete 491 feet over all, and finally a timber dry dock 658.9 feet over all. The largest ship in the navy can be docked here, and thoroughly overhauled and repaired. Besides the Navy Yard plant, New York harbor is well supplied with shipbuilding plants and shipyards. The largest private docks are owned by J. N. Robins Company, one being 510 feet over all, with 22 feet of water on the sill, and one 600 feet over all, with 25 feet of water on the sill. These two are built of wood of the Simpson type. This company owns several floating docks, the largest being 353 feet long with a lifting capacity of 6,000 tons. The J. N. Robins Company are concerned principally in making repairs, and almost any of the Trans-Atlantic ships can be docked at their yard. The Townsend and Downey Shipbuilding Company, located on Shooter's Island, between Staten Island and New Jersey, has facilities for building and repairing steel vessels, and have two marine railways capable of handling vessels of not more than 5,000 tons.

Near the mouth of Newark Bay, in Elizabeth, N. J., the Crescent Shipyard Company has established a plant where tug boats, oil barges, light draught river steamers, yachts, gunboats, torpedo boats, submarine boats, etc., etc., are built. The 345 foot steel car float for the Cape Charles route of the New York, Philadelphia & Norfolk line is the longest vessel constructed at this yard, with a 47 foot beam and a depth of 12½ feet. Another large vessel constructed here is the 3,200 ton U. S. S. Chattanooga. Not owning any docks of their own the Crescent Company make use of those belonging to the New Jersey Dry Dock & Transportation Company, also at Elizabeth.

At other points in New York harbor are located floating docks with a capacity sufficient to enable them to lift almost any of the vessels docking at New York, except the largest Trans-Atlantic liners. The principal ones being the Morse Shipbuilding Company in South Brooklyn, with a lift dock capable of handling vessels of not over 15,000 tons, and the Tietjen & Lang docks at Hoboken, with four lift docks for small repair work; also at Hoboken is located the W. A. Fletcher Iron Works, where are constructed and repaired boats of the class used in inland navigation of this country.

Near Philadelphia is located the League Island Navy Yard. This yard is well equipped to make all kinds of repairs, both large and small. The existing dry dock is 491.7 feet over all and has 25.5 feet of water over the sill. A concrete and granite dry dock is now in course of construction, 739.5 feet over all, with 30 feet of water on the sill. Cramps Shipyard, established in 1830, and the best known private yard in this country, is located in Philadelphia. Here most of the United States battleships were built. A large fleet of both naval and merchant ships were built at this yard. The Simpson dry dock of this company is 462 feet over all. Philadelphia is particularly well adapted to do repair work, and, if not the largest manufacturing city in the United States, the facilities for the con-



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struction and repair of engines, boilers, etc., are unexcelled. Across the Delaware River at Camden, is located the New York Shipbuilding Company, who, with a modern yard, with covered shipways and the most up-to-date appliances, are capable of constructing and repairing vessels of any size. These works are still in their infancy, but they have a large capacity.

At Wilmington, Del., are located the Harlan & Hollingsworth Company, which can construct ships up to 450 feet in length, with proportionate beam, and equip same ready to go into commission. Their Simpson dry dock is 350 feet long, with 13½ feet of water over the sill. The yards are equipped not only to build, but to make extensive repairs.

At Baltimore large and extensive shipyards have been built in the vicinity on the Patapsco River. At this point the Baltimore Shipbuilding & Dry Dock Company have facilities for docking ships 437 feet in length, 45 feet in width and 22 feet in depth, their dock being 504 feet long on top, with 23 feet of water on the sill. The range of the tide is about one foot. The plant of this company is up-to-date, and they can handle both old and new work economically and with despatch. There are two large dry docks, one the property of the Columbia Iron Works & Dry Dock Company, 505 feet over all; the other 600 feet over all, belonging to William Skinner & Sons. There are also several machine shops and shipyards at this point, where large and extensive repairs can be made. The Columbia Iron Works & Dry Dock Company, the Enterprise Marine Engine & Boiler Works, the People's Machine & Boiler Works, and the Maryland Steel Company are all large works for repair and construction.

Newport News, Va., is the home of the Newport News Shipbuilding & Dry Dock Company, which has a large and extensive plant, where the largest ships, both naval and mercantile, can be built, overhauled and repaired. The two Simpson dry docks at this point are 610 feet and 827 feet, respectively, in length on top. Vessels up to 64 feet beam can be docked.

The Norfolk Navy Yard at Gosport, opposite Norfolk, Va., has a granite dock 319 feet 8 inches long, and a timber dock 491 feet over all. The shops at this yard are of sufficient capacity to build as well as to repair government vessels.

At Port Royal, S. C., the Navy Yard at this point has one timber dock 484 feet 6 inches long, of sufficient size to allow 10,200 ton ships of the class of the U. S. S. Indiana to be docked. This yard is only adapted to make repair work. At Pensacola, Fla., the government has a floating dry dock 201 feet 2 inches long. Moderate repairs can be made at this station. The works of Cosgrove & Company, and Cready & McClintock, where large repairs can be made, are also located here.

At New Orleans, La., there are two floating docks of 200 and 300 feet in length which can be used together to give a length on the keel blocks of 487 feet; the Johnson Iron Works, A. A. Mims, and the Whitney Iron Works do the work of repairs in conjunction with the docks. The U. S. Naval Station is situated at Algiers in the vicinity of New Orleans, where government has a steel floating dock 525 feet long. The yard is not well equipped to do any work excepting very small repairs.

The harbor of San Francisco, the largest

city of the Pacific slope, is well supplied with yards and docks for construction and repairs of ships. The California Dry Dock Company has a stone dock cut in the solid rock at Hunters' Point, where the U. S. S. Oregon has been docked. This company, with the Risdon Iron Works, are well fitted to do the heaviest machine work. The dock referred to above is 490 feet long with a depth of 23 feet over the sill. The Union Iron Works in this city have a 446 foot steel hydraulic lift, with a 4,750 ton capacity. They are well adapted to build the largest ships, both naval and merchant. This yard was made famous as the builders of the 9,600 ton U. S. S. Oregon, which made the run around the Horn during the Spanish war, and arrived at the Cuban coast fit and ready to take part in the battle of Santiago. In addition to the hydraulic lift, this company operates 2 large graving docks, one 420 feet long, with 28 feet of water on the sill, the other 700 feet long, with 30 feet of water on the sill, and several smaller ones with a capacity of 1,200 to 1,600 tons.

The Naval Station of California is located at Mare Island. This station possesses two docks, one 510 feet 6 inches long, built of granite, the other 739 feet 6 inches long over all in course of construction of granite and concrete. The yard is equipped for large and extensive repairs with a 100 ton crane.

The only other dry dock of large capacity on the Pacific coast of the United States is the naval dock at Port Orchard, Wash., within the limits of the Puget Sound Naval Station. This dock is built of timber and is 640 feet long, with 30 feet of water on the sill. The largest ship which has been docked here is the U. S. S. Oregon, with a tonnage of 9,600.

A great development has taken place in recent years in the docking and shipbuilding industries along the shores of the Great Lakes. At West Superior, Wis., a large shipping business is done in wheat and ores, large elevators and coal docks handling the freight, which is shipped chiefly by water. The American Ship Barge Company have located their yards and dry docks at this point. These yards are of sufficient capacity to make extensive repairs to ships employed on the Lakes. The two docks of this company are 537 feet and 606 feet long, with 18 and 17 feet, respectively, depth of water over the sill.

At Marquette, Mich., the water front is lined with immense docks designed for handling the vast ore business of this region. It is not supplied with any dry docks, but the Lake Shore Iron Works, located here, build and make extensive repairs to machinery. At Sault Ste. Marie, located near the Ste. Marie Rapids on the Ship Canal, a large dry dock is contemplated. The Soo Ship Canal, built (1853) to avoid shooting the rapids, was reconstructed and enlarged in 1887. The largest lock, completed in 1896, is 800 feet long, and of sufficient depth over the sill to accommodate vessels of 21 foot draught. The pumps are of sufficient capacity to empty the lock in seven minutes.

At Milwaukee, Wis., there are several small timber dry docks 312 and 315 feet in length, with 15½ and 16 feet of water over the sills. Disabled vessels can secure ordinary repairs to machinery at the shops of the Vulcan Iron Works or the Milwaukee Boiler Works. The Vulcan Iron Works can turn out shafting 16



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inches in diameter and 20 feet long, and can finish screws up to 14 feet in diameter. Their limit in castings is 13 tons.

Chicago is well supplied with dry docks and yards and shops where vessels can be repaired and thoroughly overhauled. The Chicago Shipbuilding Company owns the largest dry dock in the city; it is 525 feet over all, having a depth of water of 18 feet over the sill, and of sufficient capacity to dock lake steamers. Their shops and plant are large enough to make extensive repairs to the hulls and engines of vessels, and they further own an extensive shipbuilding plant, enabling them to build as well as overhaul the largest inland water vessels. The Marine Engine Works can make all ordinary repairs to engines, turn out shaftings 30 inches in diameter and 35 feet long, and make castings up to 20 tons in weight. The Samson Steam Forge Company turn out heavy forgings and finish same, and weld tubes up to two inches in diameter by electricity. There are, besides these, numerous boiler and machine shops where vessels may be thoroughly overhauled and repaired.

At Port Huron, Mich., a 412 foot over all timber dry dock, with 18 feet depth over the sill, affords sufficient capacity to receive the large lake steamers. The Dry Dock Iron Works and the Phoenix Iron Works repair machinery, engines and boilers. There is a floating dry dock in the harbor owned by the Wolverine Dry Dock Company, 210 feet long, with a lifting capacity of 1,000 tons.

Detroit has several large timber dry docks owned by the Detroit Dry Dock Company, the largest being 412 feet long over all and having 18 feet of water over the sill. This company owns a shipyard plant where wooden ships are built, and they make extensive repairs to machinery, engines and boilers. Shafting up to 12 inches in diameter can be made by this firm, and engines with L. P. cylinders 62 inches in diameter have been built at their works. The Eagle Iron Works also build machinery.

At Toledo, Ohio, the Craig Shipbuilding Company builds and repairs hulls and small engines, having no facilities for doing work of any great magnitude; they own, however, the largest dry dock in the city, it being 425 feet long over all, with 16 feet of water over the sill. The Eagle Machine & Iron Works and the Toledo Foundry & Iron Works build, overhaul and repair machinery. At Lorain, Ohio, the Cleveland Shipbuilding Company have built a 560 foot over all dry dock, with 17 feet of water over the sill. This dock can accommodate the lake steamers; only small repairs, however, are done.

Cleveland now carries on a large export trade by water as well as by rail, and is one of the most prominent shipbuilding cities on the Lakes. The American Shipbuilding Company has a river frontage of 1,600 feet, all of which is occupied by their yards and is devoted to shipbuilding purposes. The dock frontage of Cleveland, on the Cuyahoga River, is 67,000 feet, of which 6,000 feet is city property, and on the lake front the city owns 9,000 feet out of 12,500 feet of dock frontage. Three wooden dry docks of the following dimensions are available to vessels: one, the largest, being 50 feet wide and 500 feet long, the other two being 50 feet wide each and 450 feet and 350 feet, respectively, in length.

Besides the American Shipbuilding Company, there are a large number of repair and machine shops in active operation. The Cleveland City Forge & Iron Company are capable of building large hulls and engines, and have facilities for repairs of great magnitude. Shafting of any diameter can be made by them 60 feet long and up to 100 tons in weight. This firm built the shaft for the Fall River steamer Puritan, which is 31 inches in diameter, 37 feet long and 42 tons in weight. The Globe Iron Works make extensive repairs to engines, hulls and boilers, and make castings up to 12 tons. They have capacity for turning out shafts 6 inches in diameter and 20 feet long, and turn shafts of any diameter up to 18 feet in length.

The geographical position of Buffalo makes it the emporium of trade of the Great Lakes and its distribution to interstate points and to the Atlantic seaboard. Supplies and raw stuffs brought here by water or train are unloaded and shipped by rail or water, most of the traffic of the Northwest passing through Buffalo. It has a large and well-protected harbor on the Lake, with several miles of water front and ample facilities to handle the immense grain, lumber and coal trade which passes through her port. The harbor is amply fitted out with shipbuilding and repair plants and dry docks, the largest firm being the Buffalo Dry Dock Company. This plant is able to turn out new ships of a capacity of 4,000 to 5,000 tons, as well as to make extensive repairs to vessels. The annual capable output is about four large ships. The four dry docks owned by this company are of the following dimensions:

Dock	1.*	2.	3.	4.
Long on top.....	478' 0"	358' 0"	305' 0"	381' 0"
Long on blocks.....	438' 0"	326' 0"	270' 0"	350' 0"
Wide at entrance.....	60' 0"	65' 0"	56' 0"	65' 6"
Wide on top.....	84' 0"	43' 0"	38' 0"	45' 0"
Water on sill at mean water level.....	16' 0"	14' 0"	11' 0"	12' 6"

\*This dock is capable of taking ships 460' 0" long over all.

There are numerous other firms which are engaged in building tugs, scows, dredges, canal boats and small pleasure craft. They, however, do not control any dry docks. The Delaney Forge & Iron Company make heavy forgings, and are capable of forging shafts of any diameter up to 25 tons in weight, 45 feet in length.

At Montreal, the harbor is continually being improved, and only recently new docks and basins have been completed. The Canadian government dock is 300 feet over all; those of Cantin's and Tate's have a length of 400 feet. The docks are located in the Lachine Canal, and to reach Dock No. 1, the government dock, the vessel must pass through two 270 foot locks and sail about one half mile up the canal. A third lock of similar dimensions has to be passed before reaching Cantin's dock. The largest ship docked in dock No. 2 was 258 feet in length and 36 feet beam. Machine shops are connected with these docks, so that repairs can be made while the ship is in dock. The Allan Steamship Company have their plant at this point. Large hulls and engines can be repaired at the Caledonian Iron Works and the Laurie Engine Company's plant; the latter make castings up to 30 tons in weight.

J. A. BENDEL,  
*Engineer in Chief Department Docks, New York.*

## DOCKUM — DOCTRINAIRES

**Dockum**, dök'koom, or **Dokkum**, Holland, town in the province of Friesland, on the Ee River. Pop. 4,158.

**Doctor**, a term meaning teacher, or instructor, applied by the ancient Romans to those who delivered public lectures upon philosophical subjects. In the Middle Ages, from the 12th century, it came into use as a title of honor borne by men of great learning, as by Thomas Aquinas (Doctor Angelicus), Duns Scotus (Doctor Subtilis), Roger Bacon (Doctor Mirabilis), Bonaventura (Doctor Seraphicus), and other distinguished schoolmen. It was first made an academical title at the University of Bologna, in Italy, which received from the emperor the right of appointing *doctores legum* (doctors of laws). The University of Paris followed in 1145. Soon after the Popes granted the universities the right of appointing *doctores canonum et decretalium* (teachers of the canon law); and when the study of the civil law came to be combined with that of the canon law, the title was changed to *doctor utriusque juris* (that is, teacher of both laws). The faculties of theology and medicine followed that of law in conferring this title. In the universities of Germany the title of Doctor of Philosophy (Ph.D.) is that which regularly corresponds to M.A. in Great Britain and in America, the philosophical faculty corresponding to the faculty of arts. The degree of Bachelor is subordinate to that of Master and Doctor. The degree of Doctor is either conferred publicly, with certain ceremonies, or by diploma. In many cases it is merely an honorary degree, in other cases it is conferred after examination or when the person receiving it has presented a sufficient thesis on a subject connected with the branch of study to which the degree distinctively belongs. In Great Britain and the United States the degrees of D.D. (Doctor of Divinity), LL.D. (Doctor of Laws), and M.D. (Doctor of Medicine) have long been conferred, the first two being generally honorary. At some of the universities the degrees of D.Lit. (Doctor of Literature), and D.Sc. (Doctor of Science) have been instituted in comparatively recent times, at some also that of D.Phil. (Doctor of Philosophy). The degree of Doctor of Music is conferred at the universities of Oxford, Cambridge, Dublin, London, and Edinburgh. The degree may be honorary or conferred after examination.

**Doctor Angel'icus**, or **Angelic Doctor**, a title bestowed, by common consent of the scholastic divines, and ratified by the moderns, upon Saint Thomas Aquinas (see AQUINAS, THOMAS). Similar titles have been conferred upon other eminent mediæval divines and philosophers; as Saint Bernard of Clairvaux was called Doctor Mellifluus (of honeyed speech); Alexander of Hales, Doctor Irrefragabilis (irrefragable); William Occam, Doctor Singularis (peerless); Duns Scotus, Doctor Subtilis (subtle).

**Dr. Jekyll and Mr. Hyde**, **The Strange Case of**, a psychologic romance by Robert Louis Stevenson. Dr. Jekyll is a London physician of position and good character, who in youth showed strong capacities for evil, which he succeeded in suppressing for years. By experiment he learns the use of a drug which gives his lower nature intermittent embodiment in the form of a misshapen, repulsive creature of

violent passions, known as Mr. Hyde. The baser nature triumphs gradually. Hyde commits murder and then suicide, and Jekyll disappears forever. This was the first of Stevenson's books to become widely popular. It was published in 1886.

**Dr. Syntax**, **The Three Tours of**, a series of three books by William Combe, written in verse, and depicting the adventures of a certain Dr. Syntax, clergyman and teacher, who, on his horse Grizzle, sets out "in search of the picturesque." The work is marked by mild satire, and describes many well-sketched types of character and class. It was published in 1809.

**Doctor of the Church**, a name given to certain eminent churchmen. Benedict XIV. gave as the things required to make a man a Doctor of the Church; first, learning so eminent as to fit him to be a doctor in the Church and a doctor of the Church; second, heroic sanctity; third, the title must be conferred by a declaration of the Pope or of a general council. The third has not always been insisted upon. In canon law four Doctors of the Church are named: Jerome, Gregory, Ambrose, Augustine. Others are called doctors without the formal declaration of Pope or council: Chrysostom, Gregory Nazianzen, Anselm, Isidore, Peter Chrysologus, Hilary, Athanasius, and Basil have not the full office proper to doctors. Others who have been added by declaration of popes are: St. Thomas of Aquin, St. Bonaventura, St. Leo, St. Bernard, St. Alphonsus Liguori, and St. Francis de Sales.

**Doctor-fish**. See SURGEON-FISH.

**Doctor's Commons**, in England, the popular name for the courts and offices formerly occupied by the body incorporated in 1768 under the title of "The College of Doctors of Law exercent in the Ecclesiastical and Admiralty Courts." The buildings were situated on the east side of St. Paul's churchyard. The college consisted of a president (the dean of the arches for the time being), and of those doctors of law who, having regularly taken that degree in either of the universities of Oxford or Cambridge, and having been admitted advocates in pursuance of the rescript of the archbishop of Canterbury, had been elected Fellows of the college in the manner prescribed by the charter. The term commons refers to the meals, taken together in a common dining-room. Since the passing of laws in 1857 which made many legal reforms possible the charter of this college of doctors has been surrendered, the property sold, and the corporation dissolved.

**Doctrinaires**, dök-tre-närz', a term applied to theorists, or theoretical politicians. The name had its origin in France in 1815. After the second restoration of the Bourbons a small number of deputies would neither rank themselves among the friends of absolute power nor among the defenders of the revolution. They supported Decazes while he was minister; and several of them held offices in the ministry, as, for instance, the counselors of state, Camille Jordan and Royer-Collard. Their system embraced a constitutional monarchy, allowing the government more power than the ultra-liberals would admit; and, on the other hand, restricting the royal power more, and admitting less ap-

proach toward the old form of government than the ultra-royalists demanded. They retired with Decazes, and afterward joined the liberal opposition. The first orator among them was Royer-Collard, and their most distinguished writer out of the chamber, Guizot. They received the name of *doctrinaires* because they were looked upon more as theoretical than practical politicians.

**Dod, Daniel**, American mechanic: b. Virginia 28 Sept. 1788; d. New York 9 May 1823. He was educated at Rutgers College. He devoted himself to the study of steam machinery and the construction of steam-engines; the Savannah, the first steamship to cross the Atlantic, had an engine of his construction. He was killed by the explosion of a boiler on a steamboat, the machinery of which he had altered.

**Dodd, Anna Bowman Blake**, American author: b. Brooklyn, N. Y. She was married to Edward Williams Dodd in 1883. She has been a voluminous writer for the magazines from her youth. Her published books are: 'Cathedral Days'; 'The Republic of the Future'; 'In and Out of Normandy Inns'; 'Glorinda'; 'Falaise'; 'On the Norfolk Broads'; 'The Struthers'; and 'An American Husband in Paris.'

**Dodd, Frank Howard**, American publisher: b. Bloomfield, N. J., 12 April 1844. He prepared at Bloomfield Academy to enter Yale, but instead went into business in the employ of his father, M. W. Dodd, succeeding to the business with Edward S. Dodd, as the firm of Dodd & Mead, in 1870. He is now the head of the firm of Dodd, Mead & Co.

**Dodd, Moses Woodruff**, American publisher: b. Bloomfield, N. J., 11 Nov. 1813; d. New York 8 April 1899. He graduated from Princeton in 1837 and entered the theological seminary, but abandoned his theological course on account of failing health. In 1839 he became a partner with John S. Taylor in the publishing business; Taylor retired the next year, and the surviving partner carried on the business for 30 years, under the firm name of M. W. Dodd.

**Dodd, William**, English clergyman and forger: b. Bourne, Lincolnshire, 29 May 1729; d. London 27 July 1777. He was graduated at Cambridge in 1749 and became chaplain to King George III. in 1763. In 1777 he was arrested on the charge of forging Lord Chesterfield's name, and was hanged in Newgate.

**Dod'der**, a family of plants, probably degenerate *Convolvulaceae*, and known as *Cuscuta*. The characteristics of the family are filiform twining stems, parasitic on other plants, to which they attach themselves by suckers. They have lost all trace of leaves, even the cotyledons of the embryo being no longer distinguishable, while chlorophyll is almost completely absent. In one American species a slight trace of coloring matter has been noticed. The seed germinates very late in spring, and as the seedling rises from the ground a yellow or pink stem soon begins to show the sweeping movements of circumnutation of a climbing plant. If no plant known as the "host" is in the neighborhood for it to take up its quarters on, it falls to the ground, but retains its vitality for some weeks, by which time a victim may probably have germinated. As soon as it touches

a living plant it twines firmly round it, and a series of small wart-like adventitious roots (*haustoria*) are developed, from the centre of each of which a bundle of suctorial cells force their way through the epidermis and cellular envelope into the bast, and press against the woody tissue of the host. The portion of the dodder stem below this attachment now dies off, and there is then no longer any connection with the ground. The growing point again circumnates until it finds a new base of attachment upon the same or a different stem of the host, there to repeat the formation of suckers. In this way a tangled skein of threads is formed, over which, late in the season, the flowers, generally pink, develop in dense clusters, and the black seeds are shaken out of the capsule by the wind, or gathered with the crop. This parasite is often very injurious, fields of flax, clover, and lucerne sometimes showing well-marked patches completely desolated by the pest. These have to be mowed down and burned before new seed has set; while pains must be taken to procure seed free from those of the parasite. Preventive measures are, to make careful examination of the seed (see SEED TESTING), rejecting any that contains dodder seed and any produced upon land known to be infested by dodder. Manure of stock fed upon baled hay should always be viewed with suspicion, because the germinating qualities of dodder seeds are not impaired during digestion. When observed growing among a crop, frequent hoeing and burning are often satisfactory. Pasturing with sheep confined to the infested patches is also practised, the animals being kept for several weeks upon the land and given extra food if necessary. The most satisfactory treatment, however, is clean cultivation or the growing of a crop upon which the dodder cannot grow. There are about 100 species of dodder of wide geographic distribution, of which at least 25 are found in the western and southern parts of North America. The temperate species are all annual, but some of the tropical species are perennial. A common American name is tanglewood. It is a remarkable circumstance that *Cassytha*, a totally unrelated Oriental genus of *Lauraceae*, has not only assumed the same general mode of life, and the twining, leafless habit, but germinates and penetrates in a precisely similar way.

**Doddridge, dōd'rīj, Philip**, English Nonconformist clergyman and author: b. London 26 June 1702; d. Lisbon, Portugal, 26 Oct. 1751. He determined to enter the Nonconformist ministry and was educated at a theological academy at Kibworth, Leicestershire. In 1723 Doddridge became pastor of the dissenting congregation at Kibworth. After declining several invitations from congregations whose rigid ideas of orthodoxy he felt would be uncongenial to him, he settled in 1729 at Northampton as minister and president of a theological academy. Here he continued to preach and train young students for the ministry till shortly before his death. Doddridge was at once liberal and evangelical, and with all his religious earnestness and enthusiasm had humanity enough for such levities as cards and tobacco. His principal work is 'The Rise and Progress of Religion in the Soul' (1745), which has been translated into Dutch, German, Danish, French, and even Syriac and

## DODDS — DODGE CITY

Tamil. Besides this, may be mentioned 'The Family Expositor' (1739-56); his 'Course of Lectures,' delivered to the students under his charge, and published (1763); and a great variety of sermons on miscellaneous religious topics. His hymns, nearly 400 in number, have carried his name over the English-speaking religious world, perhaps the best known being 'Hark, the Glad Sound, the Saviour Comes'; and 'O God of Bethel, by Whose Hand.' His 'Correspondence and Diary' appeared 1829-31. See Orton, 'Life of Doddridge' (1766); Sanford, 'Life of Doddridge' (1881).

**Dodds, Alfred Amedée**, French military officer: b. St. Louis, Senegal, 6 Feb. 1842. He was educated at the Lyceum of Carcassonne and at the military school of Saint-Cyr, and entered the French army as sub-lieutenant in 1864. In 1894 he commanded the expedition which resulted in the conquest of Dahomey and the dethronement of King Behanzan. He was appointed commander-in-chief of the French forces in Indo-China in 1896. He became an officer of the Legion of Honor in 1883, commander in 1891, and a grand officer in 1892.

**Dodecahedron**, dō-dēk-a-hē-drōn, a regular solid bounded by 12 equal and regular pentagons, or having 12 equal bases. A solid having 12 faces.

**Dodge, Charles Richards**, American textile fibre expert: b. Covington County, Miss., 17 July 1847. He was educated at the Sheffield Scientific School of Yale and was assistant entomologist in the United States Department of Agriculture 1867-77, editing 'Field and Forest' 1874-7. Since 1890 he has been in charge of the fibre investigations of that department. He has published 20 special reports on fibres and fibre industries, including a 'Dictionary of the Fibre Plants of the World.'

**Dodge, Grenville Mellen**, American soldier: b. Danvers, Mass., 12 April 1831. He was educated at Partridge's Military Academy and Norwich University. He served in the Federal army during the Civil War. After the War he was chief engineer of the Union Pacific Railroad and superintended its construction, and was a member of Congress from Iowa in 1867-9. He succeeded Gen. Sherman as president of the Association of the Army of the Tennessee in 1894, and was also president of the New York Commandery of the Loyal Legion. In 1898 he was made chairman of the President's Commission to inquire into the management of the War Department in the war with Spain.

**Dodge, Mary Abigail** (pseudonym, "GAIL HAMILTON," American author: b. Hamilton, Mass., 1830; d. there 17 Aug. 1896. For several years she was instructor in the High School at Hartford, Conn. From 1865 to 1867 she was one of the editors of 'Our Young Folks.' Besides numerous contributions to current literature, she wrote: 'Gala Days' (1863); 'Woman's Wrongs' (1868); 'The Battle of the Books' (1870); 'Woman's Worth and Worthlessness' (1871); 'The Insuperable Book' (1885); 'A New Atmosphere' (1864); 'Red-Letter Days'; 'Country Living and Country Thinking'; 'A Washington Bible Class'; 'Twelve Miles from a Lemon' (1873); 'Biography of James G. Blaine'; 'Our Common School System' (1880).

**Dodge, Mary Elizabeth Mapes**, American editor, author, and poet: b. New York 1838. Since 1873 she has been the editor of 'St. Nicholas Magazine' (New York). Her best-known work is 'Hans Brinker, or the Silver Skates' (1876), which has gone through many editions and been translated into five foreign languages. Among her other works, chiefly for young readers, are: 'Irvington Stories' (1864); 'Theophilus, and Others' (1876); 'Donald and Dorothy' (1883); 'The Land of Pluck'; 'Along the Way,' a collection of poems (1879).

**Dodge, Richard Irving**, American military officer and writer: b. Huntsville, N. C., 19 May 1827; d. Sackett's Harbor, N. Y., 16 June 1895. He was graduated at the United States Military Academy in 1848. He was the author of 'The Black Hills' (1876); 'The Plains of the Great West' (1877), republished in London as 'Hunting Grounds of the Great West'; and 'Our Wild Indians' (1881).

**Dodge, Theodore Ayrault**, American military officer and writer: b. Pittsfield, Mass., 28 May 1842. He received his military education abroad. Returning to the United States, he enlisted (1861) in the Union service as a private, attaining the rank of colonel, 2 Dec. 1865. He has published: 'The Campaign of Chancellorsville' (1881); a 'Bird's-Eye View of the Civil War' (1883); 'Patroclus and Penelope: a Chat in the Saddle' (1885); and a series of studies called 'Great Captains,' comprising volumes on 'Alexander the Great' (1890), 'Hannibal' (1891), 'Cæsar' (1892), 'Gustavus Adolphus' (1895).

**Dodge, Walter Phelps**, American author and lawyer: b. of American parents in Syria 1869. He is a nephew of William Walter Phelps (q.v.). Among his works are: 'Three Great Tales'; 'As the Crow Flies'; and 'A Strong Man Armed.'

**Dodge, William Earl**, American capitalist: b. Hartford, Conn., 4 Sept. 1805; d. New York 9 Feb. 1883. He received a common school education, entered the wholesale drygoods business, and in 1833 became a member of the firm of Phelps, Dodge & Company, retiring in 1879 with a large fortune. He was president of the New York Chamber of Commerce, trustee of Union Theological Seminary, a founder of the Union League of New York, and an ardent friend of the freedman.

**Dodge, William Earl**, American merchant, son of the preceding: b. New York 15 Feb. 1832; d. Bar Harbor, Me., 9 Aug. 1903. He succeeded his father in the metal firm of Phelps, Dodge & Company, New York, and was long prominent in his native city as a man of business, philanthropist, and art patron. He was the first vice-president of the American Museum of Natural History and chairman of the Executive Committee of the Metropolitan Museum of Art, in which latter position he had been very active. He gave Earl Hall to Columbia University.

**Dodge City**, Kan., town, county-seat of Ford County; on the Arkansas River, the Atchison, T. & S. F., and the Chicago, R. I. & P. railroads; about 150 miles west of Wichita. When first settled, as a Texas cattle-shipping point, the place was noted for its lawlessness. It is the trading centre of an agricultural and stock-raising region. It is the seat of Soule Col-

lege, which is under the control of the Methodist Episcopal Church. Pop. 2,000.

**Dodgeville, Wis.**, city, county-seat of Iowa County, situated on the Illinois C., and the Chicago & N. W. railroads, about 50 miles southwest of Madison. The industries of the place are chiefly those of an agricultural region, notably creameries. The lead and zinc mines nearby add to the wealth of the city. Pop. (1900) 1,865.

**Dodgson, dōj'son, Charles Lutwidge** ("LEWIS CARROLL"), English mathematician and author: b. 1833; d. Guildford 14 Jan. 1898. He took orders in 1861, and till 1881 was a mathematical lecturer. His first publication was 'A Syllabus of Plane Algebraical Geometry' (1860); in the following year he issued the 'Formulæ of Plane Trigonometry,' and in 1864 appeared his 'Guide to the Mathematical Student.' He still remained quite unknown to the public at large, but in the next year became famous as the author of 'Alice's Adventures in Wonderland,' which, though written for the young, has found not less appreciation among those of riper years, and has been translated into many languages. Equally delightful is the continuation of Alice's adventures narrated in 'Through the Looking-glass and what Alice Found There' (1871), an exception to the common rule as to the inferiority of continuations. Both books were admirably illustrated by Tenniel. 'The Hunting of the Snark: an Agony in Eight Fits' (1876), a fantastic narrative in verse, had by no means an equal popularity, however. Among his other works are: 'Elementary Treatise on Determinants' (1867); 'Phantasmagoria and other Poems' (1869); 'Euclid and His Modern Rivals' (1879); 'Rhyme? and Reason?' (1883); 'A Tangled Tale' (1885); 'The Game of Logic' (1887); 'Curiosa Mathematica' (1888 and 1893); 'Sylvie and Bruno' (1889-93); and 'Symbolic Logic' (1896).

**Dod'tet**, a name sometimes applied to the tooth-billed pigeon (q.v.), (*Didunculus strigirostris*), of the Samoan Islands.

**Dodo, dō'dō, or Dronte** (*Didus ineptus*), the name of a very remarkable extinct bird discovered by the Portuguese, about 1507, on the island of Cerne or Mauritius; and afterward seen there by the Dutch, both at the end of the 16th and in the beginning of the 17th century. The last authentic record shows its survival until 1681. As it was never seen after this, it was deemed by some altogether fabulous; but its actual existence was completely established not only by drawings made by artists who accompanied the Dutch voyagers, and preserved in Utrecht, Vienna, and Berlin, but by fragments of the bird itself; among others, a foot in the British Museum, and both a head and a foot in the Ashmolean Museum, at Oxford. Several other fragments, and even entire embalmed birds, reached certain of the continental museums, but seem to have been mostly lost or destroyed. In 1865, and again in 1889, large numbers of bones of the dodo were found in a marsh in Mauritius, from which an almost complete skeleton has been set up in the British Museum, and others distributed to various collections. The dodo had short and ill-shaped legs and feet, scarcely able to support its clumsy and almost globular body, which was

about twice as large as that of a turkey; and a monstrous head which, apparently ill-attached to its body, contained an enormous mouth and terminated in a strong hooked beak. Though covered with thick plumes, it was destitute of wings sufficient for flight, and had their place supplied by mere stumps or rudimentary appendages, covered with soft ash-colored feathers, intermixed with yellowish-white; the tail was composed of a few small curled feathers of the same description. Naturalists are now agreed that the dodo should be put in the order *Columba* (q.v.) or pigeons, of which it, with one or two similarly extinct birds from neighboring islands, is the representative of an extremely modified family type (*Didida*). The cause of the extinction of the dodo, together with several of its associates in the land fauna of Mauritius, is said to have been the hogs which, let loose from the ships of the early explorers, multiplied greatly and overran the island. Consult: Strickland and Melville, 'The Dodo and its Kindred.'

**Dodona, dō-dō'nā**, a celebrated town in Epirus, in the neighborhood of which was one of the most ancient oracles in Greece. This oracle long maintained its celebrity. It belonged to the Pelasgic Zeus, who was supposed to dwell in the stem of an oak-tree. The prophetic priestesses announced the divine communications in different ways. They approached the sacred tree, and listened to the rustling of its leaves; or, standing by the fountain at the foot of the tree, observed the murmuring of the water which gushed forth from the earth, and in other ways. The sanctuary at Dodona was destroyed by Dorimachus, the Ætolian general, in 219 B.C. See ZEUS.

**Dods, Marcus**, Scottish theologian: b. Belford, Northumberland, 1834. He was educated in Edinburgh, and in 1858 was licensed as a minister of the Free Church of Scotland. In 1866 he was ordained to Renfield Free Church, Glasgow, where he remained till appointed in 1889 to the chair of New Testament exegesis in New College, Edinburgh. Among his published works some of the most important are: 'The Prayer that Teaches to Pray' (1863, 6th edition 1889); 'Epistles to the Seven Churches' (1865); 'Israel's Iron Age' (1874); 'Mohammed, Buddha, and Christ' (1877); 'Handbook on Genesis' (1882); 'Parables of Our Lord' (1883 and 1885); 'How to Become Like Christ' (1897); 'Genesis, John, and First Corinthians in the Expositor's Bible.'

**Dods'ley, Robert**, English dramatist and bookseller: b. Mansfield, Nottinghamshire, 1703; d. Durham 25 Sept. 1764. He became a footman, and published by subscription a volume of poems, entitled the 'Muse in Livery,' which attracted public favor, less from its intrinsic merit than from the situation of the author. His next effort was the 'Toyshop,' a dramatic satire. Pope patronized this, and through his influence it was brought upon the stage in 1735. Dodsley was enabled, by his profits as an author, to set up a bookseller's shop in Pall Mall, which ultimately proved very prosperous. He next wrote the farce of the 'King and the Miller of Mansfield,' founded on an old ballad, which succeeded so well that he produced a sequel to it, called 'Sir John Cockle at Court.' In 1741 he brought out a musical piece, entitled the 'Blind Beggar of Bethnal Green.' He subsequently wrote:



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'Economy of Human Life,' a well-known collection of moral maxims; a tragedy, 'Cleone'; and a selection of fables in prose, with an 'Essay on Fables' prefixed. He planned the 'Preceptor'; the 'Annual Register' (commenced in 1758); the 'Collection of Old Plays,' which now chiefly sustains his fame as a publisher; and the 'Collection of Poems by Different Hands.'

**Dodson, John E.,** American actor: b. England 1857. He studied law, but early in life went on the stage, appearing first in Manchester; he supported Charles Manchester and other star players in England; and in 1889 came to the United States with Mr. and Mrs. Kendal. His first appearance in New York was at the Fifth Avenue Theatre in 'A Scrap of Paper'; later he joined the Empire Theatre Company as leading comedian. He originated the character of Richelieu in 'Under the Red Robe,' and has taken the part of Richelieu in 'Richelieu's Stratagem,' and the part of John Weatherby in 'Because She Loved Him So.'

**Dodwell, Henry,** English critic and theological writer: b. Dublin 1641; d. 1711. In 1688 he was chosen Camden professor of history at Oxford. After the revolution, his high-church principles inducing him to espouse the cause of the non-jurors, he was deprived of his office. He produced a multitude of works relating to theological and classical literature. Of these the most valuable is entitled 'De Veteribus Græcorum, Romanorumque Cyclis, Dissertationes X., cum Tabulis Necessariis.'

**Doe, John, and Richard Roe,** two fictitious personages in law who formerly appeared in a suit of ejectment. The former was the plaintiff and the latter the defendant. The fiction on which their appearance was based was abolished by the Common Law Procedure Act, and now accordingly they do not appear in England. In American usage, attempts have been made to substitute other names, but in proceedings where the identity of the alleged criminal is not known, or is designedly concealed for any reason, John Doe is the favorite term employed.

**Does, doos, Jacob Van Der** ('THE ELDER'), Dutch painter: b. Amsterdam 4 March 1623; d. 17 Nov. 1673. After study with local masters, he lived in France and Italy, painting landscapes of merit, but dark and spiritless in many instances. He had two sons, Jakob and Simon, both painters of note.

**Doffer** (doff, to put off), a small and slowly revolving cylinder, which strips the cotton or wool from the cards on the main cylinder of a carding machine.

**Dog,** a mammal of the order *Carnivores*, family *Canida*. The origin of the domesticated dog is unknown, but probably it is of composite descent from the jackal, with a certain admixture of wolf indicated, or possibly these have been intermingled with the blood of dog races tamed by men in different parts of the world. When the different tribes and races of men drifted about the earth's surface they took their dogs with them and no doubt breeds were mixed and races exchanged. By naturalists and writers in times gone by, dogs have been divided into groups, but for practical purposes at the present time they are divided into two classes:—sporting dogs and non-sporting dogs. Contro-

versies still rage as to the origin of certain classes of dogs, but almost all hounds that run by scent and the greyhound that runs by sight were of Persian, or at any rate Asiatic origin. The pointer in scientific parlance is the same dog as the hound, and the setter is a large spaniel. The Molossus of the ancient Greeks may be the same as the Thibet mastiff, and progenitor of the Great Dane, boarhounds, mastiffs, and possibly the bulldog.

The main characteristic of the dog is his reliance on man, upon whom he looks as head of the pack. Wild breeds of dogs are the Australian dingo, the Cape hunting dog, the raccoon dog, the Hindoo dhole, and the Venezuelan mountain dog now merged with the Guariquin dog.

In enumerating the breeds we have to deal with at the present day the following comprises the category as met with at the leading dog shows held under the auspices of recognized kennel clubs, or that are used in the ordinary vocations or sports of life:

### Non-sporting Dogs

Mastiff.	Toy Spaniel.
St. Bernard.	Japanese Spaniel.
Newfoundland.	Maltese.
Collie.	Pomeranian.
Smooth Collie.	Italian Greyhound.
Bobtail Sheepdog.	Schipperke.
Poodle.	Chow Chow.
Dalmatian.	Chihuahua.
Bulldog.	Bull Terrier.
Pug.	Boston Terrier.

### Sporting Dogs

Bloodhound.	Irish Water Spaniel.
Foxhound.	Clumber Spaniel.
Staghound.	Sussex Spaniel.
Harrier.	Black Field Spaniel.
Beagle.	Norfolk Spaniel.
Otterhound.	Cocker Spaniel.
Deerhound.	Bassetthound.
Greyhound.	Dachshund.
Whippet.	Fox Terrier.
Great Dane.	Scottish Terrier.
Wolfhound.	Skye Terrier.
Borzoi (Russian Wolfhound).	Irish Terrier.
Pointer.	Welsh Terrier.
Setter.	Dandie Dinmont.
Retriever.	Airedale.
	Bedlington.

The interests of the dog and its betterment in breed and those qualities that make the animal valuable are looked after by clubs and associations principally in the United States, England, France, Germany, Austria, Russia, Italy, Australia, and South Africa, in which countries official shows are held at stated times and the rules governing these organizations are recognized so far as breeds are concerned by these governments. A large number of illustrated magazines and journals in all parts of the world are devoted to the interests of the canine race. The principal ones in England are: 'Our Dogs'; 'Stock-keeper'; 'Illustrated Kennel News'; and 'The Field'; in the United States: 'Rider and Driver'; 'Field and Fancy'; 'Dog Fancier'; 'The Kennel'; 'The Sportsman's Review'; 'Stock-keeper'; 'The Field'; and 'The Dog.'

**BLOODHOUND.**—In general appearance this noble animal impresses one as the most dignified of any dog. The head is long and clean with tremendous wrinkles and pendulous ears, the eye is small and deeply set, and shows much of the hawk. The old fallacy of bloodhounds being ferocious is absurd; they hunt or trail persons by scent and on finding their quarry do



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not attack, but stand baying until the pursuers arrive.

**Standard.**—Skull long, narrow, and very much peaked; muzzle deep and square; ears set on very low, thin, and hanging in graceful folds close to the face; deep-set eyes, with triangular lids showing the red haw; flews long, thin, and pendulous, the upper lip overhanging the lower one; neck long, with profuse dewlap; skin of face very loose and wrinkled; coat close; skin thin; shoulders deep and sloping; brisket well let down; loins broad and muscular; powerful thighs and second thighs; good legs; round feet; hocks well bent; tapering stern. Colors: black and tan, red and tan, and tawny.

**St. BERNARD.**—This magnificent dog takes its name from the monastery of Mt. St. Bernard, Switzerland, and is remarkable for its high order of intelligence. It was used by the monks for rescuing travelers lost in the snow. The old type which was small and somewhat plain in head is fast dying out, the present show specimens being more on the mastiff type of head.

**Standard.**—Head very massive and large, showing great depth from eye to lower jaw; face rather short, muzzle wide, deep, and cut off square; lips hanging down well and rather loose, the stop well defined, but not too abrupt; skull massive and well rounded; eyes dark in color, of medium size, rather deeply set, the lower eyelid drooping slightly, so as to show a little of the red haw; ears rather small, lying well to the cheek, and very slightly feathered in the rough variety; nose black in color, wide, and deep, legs straight, with great bone and muscle; hocks and stifle well bent; feet large and compact; body rather long, broad, straight, and ribs well rounded. The coat of the smooth- or short-coated variety should be very close, thick, and slightly broken-haired. In the rough variety the coat should be dense and flat, of medium length, not woolly, rather long on the neck, thighs, and tail. Color and markings: orange, orange-tawny, and all shades of brindle and red. The markings should be as follows: White muzzle, white blaze on face, shaded with black, black shadings on the ears, white collar round neck, and white on chest, legs, and tip of tail. The body may be white with patches of any of the above colors.

**GREAT DANE.**—This dog is a most symmetrical animal, and the embodiment of agility and strength. They were originally used in Denmark and Germany for boar and deer hunting. They make ideal watch dogs.

**Standard.**—Head, which should be carried high, long and not too broad; muzzle broad, strong, and blunt; eyes small, with sharp expression; neck long and arched, free from dewlap; chest moderately broad; brisket deep; loin slightly arched; shoulders sloping; elbows well under; belly well drawn up; legs straight and muscular; second thighs long and strong; feet large, well arched, and close; coat hard and dense; tail strong at root, and ending fine, carried rather low. Colors: brindle, fawn, harlequin, black, white, and blue.

**MASTIFF.**—In this old breed we have probably the most massive and ferocious looking of dogs.

**Standard.**—Head large and massive; skull flatly rounded; ears small; muzzle square, deep and broad; teeth level; eyes brown or hazel-colored, and wide apart; front legs straight,

with great bone; chest deep; loins strong and large as possible; color, brindle or fawn; in both cases muzzle and ears black; size as large as possible, so long as symmetry is retained.

**NEWFOUNDLAND.**—This noble dog is famed for his remarkable fearlessness of water and the readiness with which it will risk its life to save human beings from drowning. The black dog, which is spoken of as the true Newfoundland, is a trifle larger than the Landseer type, which is a black and white dog. Much controversy has taken place as to whence white markings came, some claiming a spaniel cross.

**Standard.**—Head broad and massive with flat skull and somewhat square muzzle; ears small and lying close to the head; coat straight and dense and capable of resisting water; tail carried gaily, but not curled over; color black, black and white, or bronze; average weight, 100 pounds for dogs and 85 pounds for bitches.

**POINTER.**—That this breed was descended from the hound was first clearly indicated by Youatt. The disposition to point appears to be due to training, and although other dogs have been taught to point, in no case do they assume the same rigid position so notable in the pointer. This breed is marked by a compact and well knit body, sloping shoulders, muscular limbs, and beautiful action. The head is large and flat, stop well defined with a depression running from the top to occiput, muzzle long and square, with not too much lip. Colors are white with black, liver, and orange markings, and solid black and liver.

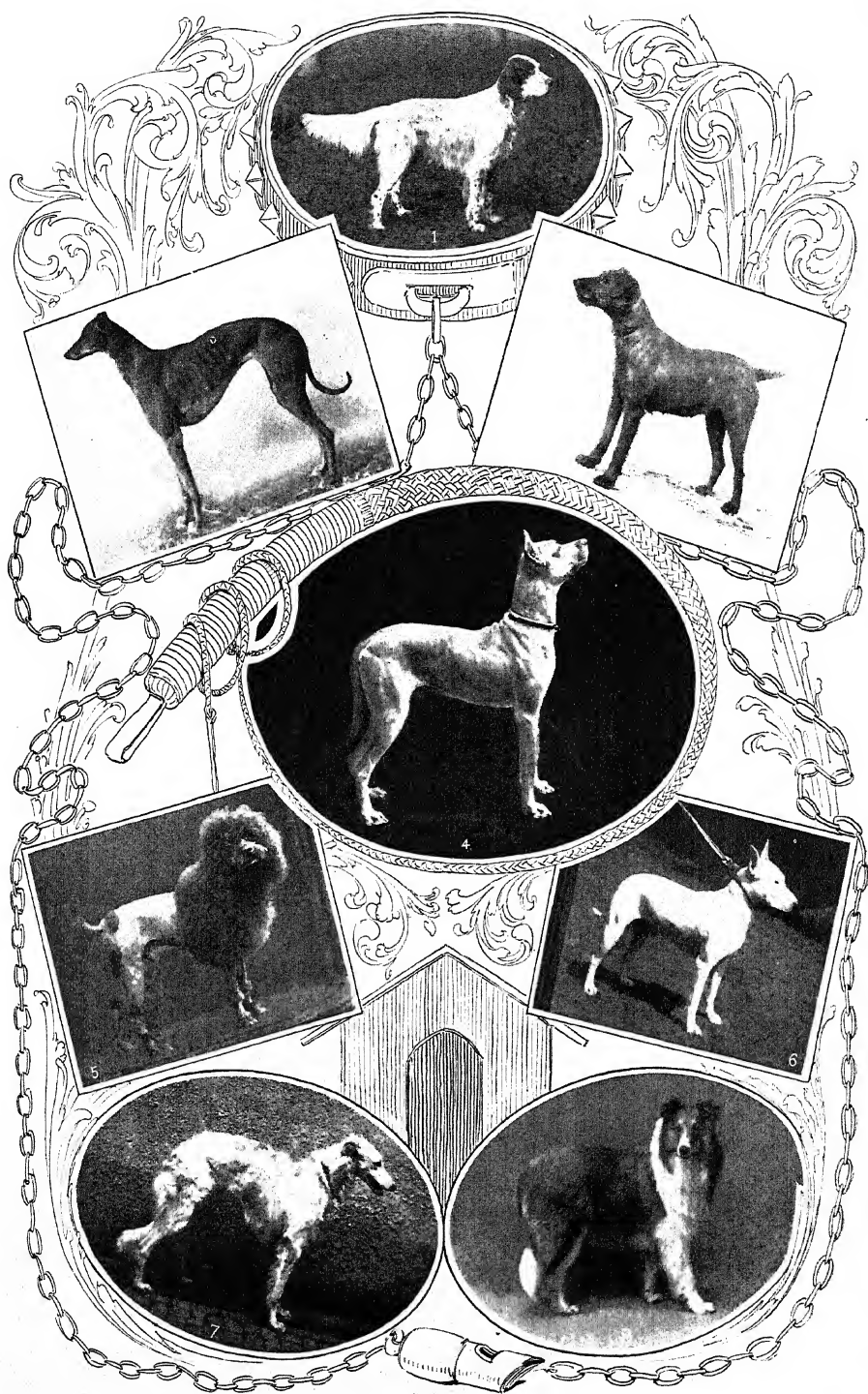
**GREYHOUND.**—The English greyhound, which is of great antiquity, has been regarded by some as the ancestral stock of the majority of our domestic dogs, but this is doubtful. It is easily distinguished at a glance from all other dogs by its graceful outline and large size. Greyhounds hunt entirely by sight instead of scent.

**Standard.**—Head long and lean, rather wide between the eyes and flat at the top; jaw powerful, but cleanly cut; teeth level and white; eyes bright; ears small and fine in texture and rose-shaped; neck long and muscular, elegantly arched, and free from throatiness; shoulders oblique and muscular; chest deep and capacious; back broad and square, rather long and slightly arched over loins which should be strong and powerful; forelegs rather long and set under dog, possessing fair amount of bone; hind quarters strong and broad across, stifles well bent, thighs broad and muscular, hocks well let down; feet round, well split up with strong soles; tail long, tapering, and nicely carried; coat fine and close; color, black, red, white, brindle, fawn, blue, and the various mixtures of each.

**WHIPPET.**—This breed is the result of a cross between a greyhound and a terrier, and is bred especially for rabbit coursing and racing. In the latter sport these dogs are without doubt the most speedy animals known, even exceeding the speed of the racehorse for a short distance. In outline they are identically the same as the greyhound.

**STAGHOUND.**—It is a large hound, white in color with black and tan markings; the head somewhat on the pointer type, but the ears more pendulous and set lower. This breed has been used for many years in Europe for stag hunting.

**DEERHOUND.**—The Scotch deerhound is larger and more massive than the English greyhound, frequently standing as high as 28 to 30



1. English Setter.
2. Greyhound.
3. Irish Terrier.
4. Great Dane.

5. Poodle.
6. Bull Terrier.
7. Russian Wolfhound.
8. Collie.



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inches at the shoulder, the body being clothed with a rough coat. Its principal use is for deer-stalking in the Highlands.

**Standard.**—Head long and narrow, tapering gradually from the ears; nose black (occasionally blue) and pointed; lips level; ears small, set high, carried in a fold, soft and silky, and free from long hair; neck long, but strong, with the nape or crest very prominent; shoulders sloping; toes close and arched; chest deep; body long, but well ribbed up; loins arched with great breadth across hips; stifle well rounded; thighs long; tail set on low, curved but not curled; coat rough and harsh on body; mane on neck and slight fringe on inside legs, on thighs and on tail. Colors: All shades from dark blue or black brindle to light gray brindle, yellow, fawn, dun, and drab; white markings objectionable, but very often to be found on chest and toes.

**IRISH WOLFHOUND.**—This ancient breed was famous for many years in Ireland for its great power and strength and its prowess against wolves. It has practically the same lines as the deerhound only more massive in skull and body. The colors are the same.

**BORZOI or RUSSIAN WOLFHOUND.**—Is of rather larger build than his English cousin, being covered with a wavy silky coat quite different in texture from that of the deerhound and wolfhound; the head is more domed and muzzle of the Roman nose type. It is used in Russia for hunting wolves. Colors are white with drab, fawn, or brindle markings.

**ITALIAN GREYHOUND.**—This breed is kept purely as pets and may be regarded as a miniature greyhound. The eyes are much larger and more prominent than in the large greyhound. There are several colors, among which are a golden fawn and a mouse fawn, the most valuable colors; white markings are undesirable.

**ENGLISH FOXHOUND.**—The modern foxhound is somewhat smaller than the staghound and cobbler in body; the head is cleaner with more substance in the muzzle; the ears are rounded and placed much higher on the skull. The American foxhound is much the same type, but somewhat smaller and lighter built, the colors often being black and tan, showing a bloodhound cross.

**BEAGLE.**—This term is generally applied to any hound standing less than 15 inches high, although the true pure breed beagle is a distinct breed, which may be regarded as a miniature foxhound with the exception of the ears, which are more pendulous; the height varies from 9 to 15 inches. The beagle has a musical note and an acute scent as well as great perseverance in following a trail.

**SETTERS.**—The various breeds known as setters are practically large spaniels which acquired this name from being taught to crouch when marking their game.

**ENGLISH SETTER.**—It is regarded as a result of a cross between the field spaniel and the pointer, and should have a soft coat with a slight wave, but no curl in the hair. There is a great variation in color, which is valued according to the following scale: black and white ticked with large splashes, or the Blue Belton; then orange and white freckled, known as the "Orange Belton"; black and white with tan markings; and black and white.

**Standard.**—Head long and lean with a flat skull; muzzle long and deep; lips not too pen-

dulous; ears of moderate size, fine in texture, set on bone, and well back; neck long, muscular, and well set in sloping, deep shoulders; chest narrow, but deep, and ribs well sprung; loins muscular and slightly arched, with powerful hind quarters; front legs perfectly straight, and feet small and firm; toes arched and close together.

**IRISH SETTER.**—Of a deep-red mahogany color, this dog is rather lighter in build than the English setter, with a narrow and slightly domed head.

**THE GORDON** or black and tan setter is much heavier than either the English or Irish breeds, this heaviness being especially shown in the head, which is broader and deeper. The body should be massive and black with tan markings.

**RETRIEVER.**—This name applies to a large dog somewhat on the order of the setter, employed for retrieving game. They have more or less Newfoundland blood in them and trace their parentage to the water spaniel or setter. The curly-coated retriever, which may be either black or liver color, is the product of a cross between the smaller black Newfoundland and the Irish water spaniel. It is characterized by the short hair of the face and the tail devoid of any fringe, although covered to within a few inches of its extremity with short, crispy curls. The hair on the body is closely and crisply curled, hence the old phrase of the "nigger-coated retriever," a term used in some counties in England. The wavy or flat-coated retriever has the same outline, with the exception of the coat, which is flat and wavy, and is close to the body.

**CHESAPEAKE BAY DOG.**—As the name signifies, this dog is a native of Chesapeake Bay. It resembles a dull-colored red retriever both in color, shape, and size. The coat is extremely dense and absolutely waterproof. For general retrieving work in the water we know of no dog which can equal it. It has been known to work the whole day in the ice and never seems to tire.

**SPORTING SPANIEL.**—The Clumber spaniel derives its name from Clumber Park, the estate of the Duke of Newcastle, where this breed has been kept for many generations. The Clumber is distinguished by its silence when hunting, and is a large, low, heavy, massive dog, with immense bone.

**Standard.**—Large, low, heavy, and massive throughout, with immense bone; head large, with largely developed forehead; brows heavy and eyes deeply set; muzzle long and very square, with a fair quantity of lip; ears small when compared with the size of the dog, and well shaped, hanging close to the face. Color is white with lemon markings.

**FIELD or BLACK SPANIEL.**—It is somewhat on the Clumber style, but has much more activity, a longer muzzle and cleaner head.

**Standard.**—Head long and lean, with a good length of muzzle, which must not be snippy; a short, coarse, or clumpy head is objectionable; eyes dark; ears very low down, narrow where they leave the head, long and lobe-shaped; body large, deep, long, and low; tail carried below the level of the back; legs straight, strong, short, and very large in bone. Although a long, low dog, he must be active, with plenty of life, and any resemblance in shape, action, or movement to the bassetthound or dachshund should be discarded.

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**COCKER SPANIEL.**—The weight of this variety of spaniel at exhibitions is usually under 26 pounds. The head is long and narrow, but not quite so lean or long as the field spaniel, the muzzle well developed and not snippy; eyes dark, and although not full or prominent, a little larger in comparison with the size of the dog than the eye of the field spaniel; ears long, and small near the head, set low, and lobe-shaped; body large, deep, and round throughout, and in length much shorter than in the field spaniel; stern set low; legs powerful and straight, and a little longer than the field spaniel; and coat flat and abundant, but not too long; and with plenty of feather. It should be remembered that, although a small spaniel, the cocker is a sportsman's dog, and any trace in shape, make, expression, or action of the toy spaniel should be discarded.

**IRISH WATER SPANIEL.**—This quaint animal is possibly the most useful all-around worker of the whole group of spaniels. The general appearance is that of a big upstanding shaggy liver-colored dog with a strong head and a distinct top-knot, a well furnished cobby body, and a rat-like tail. These dogs are especially fond of the water and good on all retrieving work.

**DALMATIAN.**—The Dalmatian or coach dog is probably allied to the pointer. It is distinguished by the spots which are black or liver, on a white ground. Its use in England and America is essentially as a carriage dog, and it devotes itself entirely to the horse, often sleeping in the same stall. In its native country the Dalmatian is used as a pointer and is said to be staunch on game.

*Standard.*—Head longish, skull flat, moderate amount of stop; muzzle long and powerful; eyes medium size, and dark or light according to markings; neck fairly long and arched, no throatiness; chest very deep, not wide under; feet compact, well padded; tail smooth, slightly curved upward; coat short, hard, dense; ground color pure white; spots pure black or liver color; very decided, not intermixed; ears and tail well spotted; weight 50 pounds. The general appearance is that of a pointer.

**SHEEP DOG.**—The Collie is essentially of Scotch origin. In appearance it is one of the most handsome of the canine race, having a well-knit frame, chest deep, but not wide; fore legs straight, hocks well bent, feet compact and strong. The head should be long, fairly narrow, and flat; ears small, set well back on the head, and carried semi-erect, but not pricked. Colors are black and tan, black, tan and white, sable, and sable and white.

**SMOOTH COLLIE.**—Is practically on the same lines as the rough collie, with the exception of the coat, which is smooth and lies very close, and the eyes, which, in many cases, are china or wall-eyed, that is of a whitish color.

**OLD ENGLISH (BOBTAIL) SHEEP DOG.**—This quaint old breed is quite different in type from the other sheep dog, having a short, wide skull and very massive body, which is covered with a rough, shaggy coat, with an abrupt, or bob-tail, hence the name. Is much used in England by the drovers and is locally known as the drover's dog.

*Standard.*—Color, any shade of blue, blue merle or grizzle, with white on face or legs for relief; head big and square; eyes small and dark; in very light-colored dogs wall or

marble; square in body and as large as possible, with a broken, harsh, wavy coat; ears small and neatly set on side of head.

**BEARDED COLLIE.**—Is practically a repetition of the bob-tail, with the exception of the tail, which is long and carried low, and the body, which is not quite so short or massive.

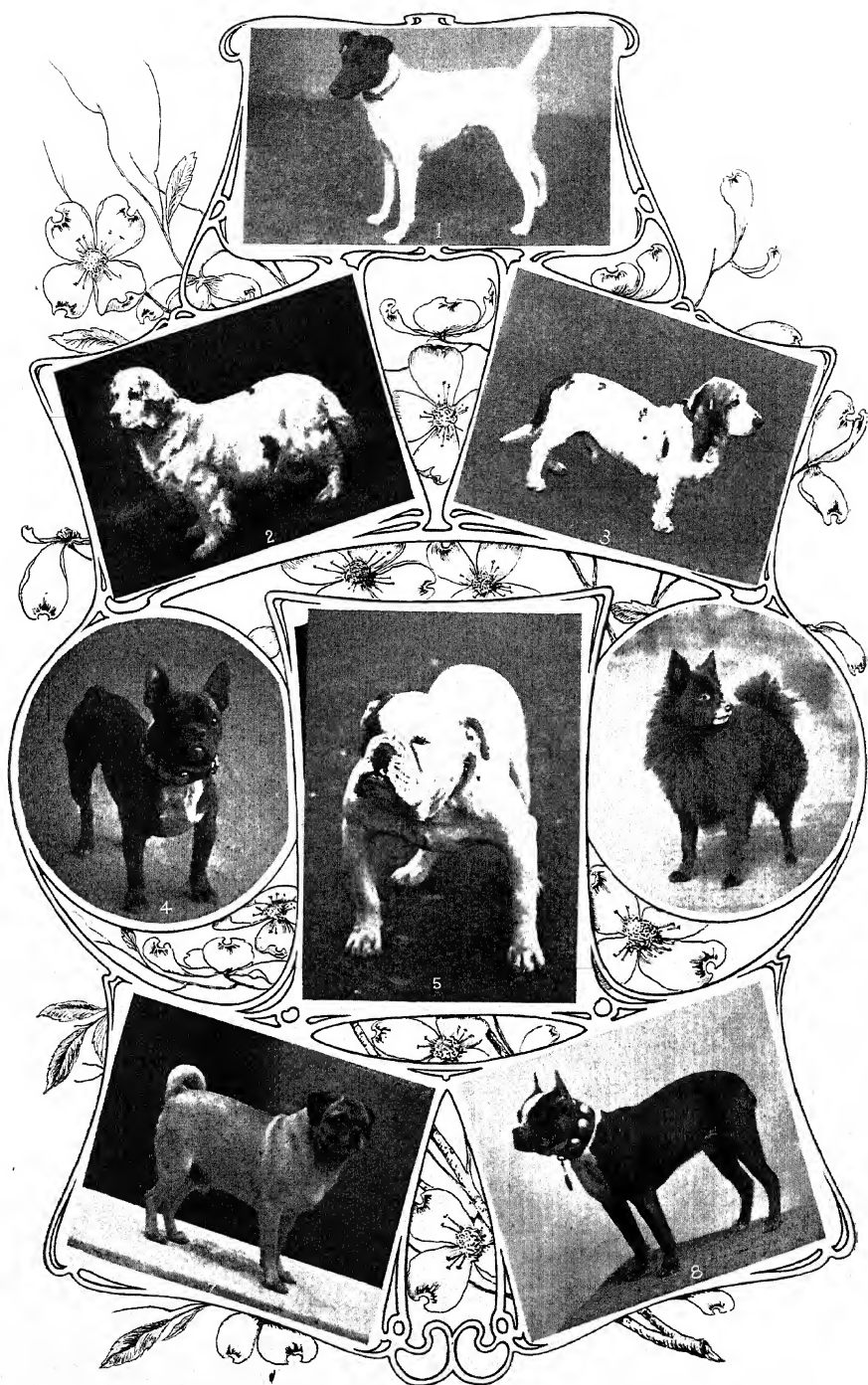
**BULL-DOG.**—This breed is, without doubt, the most maligned of the canine race. In appearance it is that of a low cobby dog, with a very large flat skull, showing much wrinkle, short nose or face and a long, wide turned-up under-jaw. In body is low and wide in front, with well sprung ribs and a short roach or wheel back, and a short, tapering tail, which must not be carried above the level of the back. Since the old-time sport of bull-baiting has been done away with the bull-dog has been bred especially as a pet. They are, in no way, fighters, being, without doubt, the most affectionate of all breeds.

*Standard.*—Thick-set and compact; very heavy in front, and of comparatively lighter build behind; legs short, muscular, and set outside the body, but not exaggerated; shoulders massive, and standing well out; chest wide and deep; skull large; and temples high, with stop well defined; eyes wide apart, and dark in color; underjaw wide, and well turned up; nose large, black, and very short; strong loin, well tucked up; tail short and set on low; colors, all shades of brindle, fawn, white, and all pied colors.

**TERRIER.**—The bull terrier, as its name implies, is a cross between the bulldog and the white English terrier. The general appearance is that of a symmetrical animal, the embodiment of agility, strength, and determination. The ears are cropped, which gives a smart and alert appearance. The popular color is pure white with small black eyes and nose; a cherry or flesh-colored nose is undesirable.

*Standard.*—Head long, flat, and wide between ears, tapering to nose without cheek muscles, slight indentation down face, without a stop; jaws long and very powerful; large black nose, and open nostrils; eyes small and very black; lips meeting as tightly as possible without a fold; teeth regular in shape and meeting exactly, a deviation being a great fault; ears always cropped; neck long, slightly arched, nicely set in shoulders, tapering to head, without any loose skin; shoulders strong, muscular, and slanting; chest wide and deep; ribs well rounded; back, short and muscular; fore legs perfectly straight, with well developed muscles, not "out at shoulder," and very strong in pasterns; hind legs long, muscular, and good strong, straight hocks, well let down; feet like those of a cat; color white; coat short, but close, stiff to the touch, and with fine gloss; tail set on very low, and 10 to 12 inches long, thick where it joins the body, tapering to a fine point, carried without a curl and never over the back.

**AIREDALE TERRIER.**—This is a large, rough-coated terrier, found chiefly in Yorkshire, England. It derives its name from the river Aire, where it is much used for all hunting purposes. The general appearance is that of a big, rough-coated dog, on the same lines as the Irish terrier, but much stronger and heavier built. The colors are black and tan, and grizzle and tan, and the weight from 40 to 55 pounds. The coat should be short, very dense, and of a harsh texture.



1. Smooth Fox Terrier.  
2. Clumber Spaniel.  
3. Basset Hound.  
4. French Bulldog.

5. English Bulldog.  
6. Pomeranian.  
7. Pug.  
8. Boston Terrier.





## DOG

**SCOTTISH TERRIER.**—The general appearance is that of a low cobby rough-coated terrier with prick ears. The head should be long and narrow, with small, dark eyes and a long punishing jaw; the front legs straight, and shoulders strong, but not too broad; body short and the tail carried gayly; weight from 14 to 20 pounds; colors, wheaten, red and black brindle, and solid black. White markings are objectionable.

**SKYE TERRIER.**—This is, undoubtedly, the old Highland terrier, a long, low dog, with a long, straight coat of dark steel blue, or gray color; head broad and strong, with a long jaw; nose pointed, and eyes small, dark, and set close together; body long and low, but arched at the loins, and tail carried low, and ears pricked or drop, the latter carried low and close to the head.

**DANDIE DINMONT TERRIER.**—This game little terrier is also of Northern origin. It is low on the leg and strongly built. The head is apparently large in proportion to size; skull fairly wide and covered with a top-knot of silky, light hair. Colors are pepper or mustard; tail carried gayly above; weight not over 25 pounds.

**BEDLINGTON TERRIER.**—This breed hails from the northeastern counties of England. It is rather long and wiry in appearance, with a bluish, or sand-colored coat. The head is long and narrow, with a silky top-knot, somewhat like the Dandie, but is much narrower in skull. These dogs are exceedingly game and weigh 12 to 18 pounds.

**WELSH TERRIER.**—As the name implies, these little dogs come from Wales. They are, in general appearance, much like the Airedale and of the same color; the head is broader in comparison and eyes set wider apart. The weight should not exceed 20 pounds.

**YORKSHIRE TERRIER.**—This is a small breed, bred chiefly in the county of Yorkshire, and is easily distinguished by its very long, silky coat, especially on the face, which is parted from the nose down the whole length of the body to the tail. It is exceedingly bright and quite game, but valued chiefly as a pet. The colors are a dark blue body, with tan markings; and black with tan markings. The ears are cropped and carried erect, and the weight is between three and eight pounds.

**MALTESE TERRIER.**—This dog is on the same lines as the Yorkshire, but a trifle larger, colored pure white, with a black nose and small, deep-set eyes. The coat should be flat and not curly, which, in many cases, shows a toy poodle cross.

**MANCHESTER OR BLACK AND TAN TERRIER.**—A smooth-coated terrier which has been bred for many years in Manchester, England, derives its name thence. The general appearance is that of a smart dog with a black body and rich tan markings on the legs and feet; the division between the colors should be well defined. The ears are cropped or V-shaped. The weight is from 7 to 20 pounds. The toy black and tan is identically the same breed, but does not exceed seven pounds in weight.

**DACHSHUND.**—This quaint and very game breed is essentially of German origin. The general appearance is that of a dwarfy short-legged, long-bodied, but sturdy dog, with strongly developed muscles. The head is long and fairly broad, conical in shape, tapering toward the nose, with ears set high and broad and nicely

rounded, not pointed or folded. The legs should be short and muscular, but not over at the knees; elbows well under, and shoulders broad and well placed; loin short, firm, and broad; and tail short, but carried gayly. Colors are solid red, black and tan, and dappled. The coat should be smooth and glossy. The rough-coated variety, which is now becoming popular, is on the same lines exactly.

**POODLE.**—This is probably the cleverest of all dogs and most apt to learn tricks. Its colors are a deep black, blue, red, white, or cream. There are two varieties, the corded, which has a long, rope-like coat, and the curly, which should be short and tightly curled like astrakhan. They make ideal companions and can readily be broken to the gun and make grand retrievers.

**FOX TERRIER.**—The fox terrier is probably the most popular of all terriers. It is said to have descended from a cross between the small fox hound and the English terrier. It derives its name from the use of driving foxes from holes or burrows in the ground. The most popular color is a pure white body with black and tan markings on the head, with an even blaze up the face. The head should be flat and narrow, with a strong foreface or muzzle, eyes small, ears likewise small and of V shape, carried forward and close to the head. The body should be short, with well-sprung ribs, narrow in chest, with clean sloping shoulders, perfectly straight front and cat-like feet. The wire-haired dog is identically the same as his smooth brother, with the exception of the coat, which should be rough, with a decided harsh texture. Weight, 15 to 21 pounds.

**IRISH TERRIER.**—As the name implies, is of Irish origin and is aptly named the "Dare Devil," being very game. In size it is somewhat larger than the fox terrier, and more racy in body, and has larger feet. Cropping the ears has now gone out of fashion, the modern ear being the same as the fox terrier.

**Standard.**—Head long, rather narrow, punishing jaw, eyes small and dark, ears fairly small, not set on too high, legs straight and strong, feet round and thick, with good pads; chest narrow, with good depth of brisket, back strong and straight. Color, wheaten and red. Expression wicked but intelligent. Coat short and rough, and very harsh.

**BOSTON TERRIER.**—This smart little dog is especially of American origin having been raised in Boston and the nearby towns for the past 40 years. It resembles the bull-dog in head, but is void of wrinkle and must not show the teeth; the body should be built on the terrier type, having a narrow front, with strong, but not wide, shoulders, short back, and a short screw or tapering tail. The ears are cropped and carried erect. The three classes by weight are under 15 pounds, under 23 pounds, and not exceeding 32 pounds. Colors are brindle with white markings, fawn and white, or red and white. They are used entirely as pets.

**Pugs.**—This quaint breed is one of the most popular house pets. In appearance they resemble the bull-dog, having a short, square muzzle and heavily wrinkled head. The ears should hang close to the head and be carried forward; the body be short and round and the tail curled and lie on the back. The colors are a rich apricot fawn with black shadings and a deep black.

## DOG-DAYS—DOG-TOOTH VIOLET

**TOY SPANIEL.**—The English toy spaniels are the King Charles, or black and tan, the Blenheim or orange and white, the Prince Charles, and the Red, and are practically all of the same family, distinguished only by the colors. The head should be large and domed, with the ears set very low in the skull; the nose, or face, as short as possible and stop well defined; eyes as large as possible and very prominent; body short and well coated, and small in size. They are essentially house pets.

**JAPANESE SPANIEL.**—It is black and white, or orange and white. The head is not so large or domed as the English spaniel and the ears are much smaller and carried higher and V-shaped; eyes wide apart and showing a good deal of the white; tail heavily coated and carried over the back. In size it is as small as possible.

CHARLES G. HOPTON,  
Kennel Editor of 'Rider and Driver.'

**Dog-days** (Lat. *caniculæ*), the name applied by the ancients to a period of about 40 days, the hottest season of the year, at the time of the heliacal rising of Sirius, the dog-star; that is, the time when it rose just before the sun. The heat, which is usually most oppressive at this season, was formerly ascribed to the conjunction of this star with the sun. We still retain the expression dog-days, as applied to the hottest season of the year, but owing to the precession of the equinoxes it is no longer the time of the heliacal rising of the dog-star.

**Dog-fish**, the popular name of several species of small shark (q.v.), chiefly belonging to *Mustelus* and *Squalus*, two quite unlike genera. The name is derived from their habit of swimming in schools or packs in pursuit of their food. In their general anatomy, they differ but little from the other sharks, so well known for their ferocious and savage habits. The dog-fishes, though among the smallest of the tribe, manifest propensities equally cruel with those which have rendered the white shark and others so justly dreaded. Although seldom or never injurious to man, they commit great ravages in the fisheries, and where they abound constitute one of the greatest nuisances to the fishermen. Exceedingly voracious and devouring almost everything which they encounter, the mischief they occasion by taking the baits, and very often the hooks, of the deep-sea lines, is very considerable and not at all compensated for by the flesh of those which are captured.

The smooth dog-fish or dog-shark (*M. caninus*) is found on both sides of the North Atlantic, and on the American side is particularly abundant south of Cape Cod. It is about 2 to 3 feet long. No spines occur in the margins of the dorsal fins, and the smooth pavement-like teeth are especially adapted for crushing crabs, lobsters, and other testaceous invertebrates on which they chiefly feed. The young are hatched from the egg in the oviducts of the female (with which, however, they are not connected by a placenta, as in the related *Galeus mustelus* of Europe), and are born alive. The eggs are similar to others of the family, and covered by a tough membranaceous integument. The skin of these fish is beset with numerous small asperities, which render it, when dried, well adapted for polishing wood and for other mechanical purposes.

The spiny dog-fish (*Squalus acanthias*) is very abundant on the coasts of New England, and, although similar in size and general aspect, is readily distinguished from the smooth dog-fish by the presence of a strong spine before each of the two dorsal fins. The eggs are deposited before hatching. This species furnishes material for a valuable fishery and fish industry in Maine, where the oil is extracted from the livers, the flesh ground up for fertilizers or poultry food, and the skin utilized for polishing metal and wood. The dog-fish feeds chiefly on herring and mackerel, the schools of which it follows in immense numbers. Similar species occur in the Pacific Ocean and other seas.

The flesh of all the species is hard, dry, and unpalatable, requiring to be well soaked before it is eaten. In England the dried flesh goes under the name of Folkestone beef. Poisonous effects are at certain times observed in consequence of eating the livers of dog-fish, and some cases are recorded in which the most distressing illness has been occasioned by the practice. The name dog-fish is also applied to several other quite distinct fishes, more particularly to the western mud-fish or bow-fin (*Amia calva*), and to the dog-salmon (*Oncorhynchus keta*).

**Dog-grass.** See COUCH-GRASS.

**Dog Parsley**, one of the common names of *Æthusa cynopium*, a poisonous plant of the carrot family, the only species of the genus *Æthusa*, found in America, from Nova Scotia west to Minnesota, and south to New Jersey, having been naturalized from Europe. The fruit bears some resemblance to the fruit of dill and fennel, and is sometimes eaten in mistake for these. The sharp acrid taste marks the difference. Other names are: Fool's parsley, fool's cicely, and dog-poison.

**Dog Rose** (*Rosa canina*), a plant of the rose family (*Rosaceæ*); known also as the canker rose, wild brier, and referred to by Shakespeare as "canker-blooms." It is a native of Europe and northern Asia. The ripe fruit is sometimes used abroad to make a preserve that is employed in the manufacture of pills. The plant is naturalized in America, and is found along roadsides from Nova Scotia through western New Jersey and eastern Pennsylvania, and particularly abundant in the valley of the Delaware; it is also found in Tennessee.

**Dog-salmon**, a name given in Alaska to the *Oncorhynchus Gorbuscha*, more commonly known as the hump-backed salmon. This is a species of the widely extended Pacific salmon, which are found on the North American coasts from Alaska to as far south as Oregon or even the Sacramento River.

**Dog-star** (SIRIUS), the star that gives their name to the dog-days (q.v.). Sirius is the brightest star in the heavens, and once was thought to exercise a baleful influence upon human affairs. It is now a clear white star in the constellation Canis, though Seneca and Ptolemy describe it as red.

**Dog-tooth Spar**, a common variety of the mineral calcite (q.v.), so named because of the resemblance of the acute scalenohedrons, of which it is composed, to a dog's tooth.

**Dog-tooth Violet**, a common but erroneous name for plants of the genus *Erythronium* (q.v.).

**Dogbane**, the English name of the *Apocynaceæ*, a natural order of perennial herbs, shrubs, vines and, in some tropical genera, trees, nearly all possessing a milky acid juice. The order includes about 130 genera, and 1,050 species are recognized. They are widely distributed throughout the world, the larger number in the tropical regions. In America at least 4 genera, and 10 or more species are known. The typical genus *apocynum* is represented by the largest number, of which three are called dogbanes, the best-known being *A. cannabinum*, Indian hemp (q.v.). The spreading dogbane or honey-bloom (*A. androsaemifolium*), known also as bitter-root, is found in fields and thickets from Anticosti and British Columbia to Georgia, Nebraska, and Arizona. It belongs to the natural order *Apocynaceæ*, many of the plants of which are poisonous, and some of them drastic purgatives. The whole plant yields the acrid milky juice so common in members of the family; the root is intensely bitter and nauseous. It is the most powerful part, and is employed by country physicians instead of ipecacuanha.

**Dogberry**. See Dog-wood.

**Doge**, *dōj* (from the Latin *dux*, a leader or duke), formerly the title of the first magistrates in the Italian republics of Venice and Genoa. The first doge of Venice elected for life was Paolo Anafesto, in 697. The doge was first elected by the people, but afterward by the great council. He held his dignity for life. His power was at first almost absolute. He could convoke legislative assemblies, declare war, conclude treaties, take command of the army, appoint military officers and judges, invest bishops, and award ecclesiastical penalties. But this absolute authority became by degrees very limited. The dignity was abolished with the overthrow of the republic in 1797. In rank he was considered only equal to a duke, though the republic of Venice was in dignity equal to a kingdom. In Genoa the office of doge was established in 1339. Here also the doge was at first elected by the people, but the dignity afterward experienced numerous changes both in this and other respects. After the liberation of Genoa from the yoke of France by Andrea Doria the power belonging to this office was more systematically defined. A great and small council were created, and the duration of the office was limited to two years. After the overthrow of Genoa by the French in 1797 the dignity became extinct, although it was revived for a short time between 1802 and 1805. See GENOA; VENICE.

**Doge's Palace**, The (It. *Palazzo Ducale*), the official residence of the former rulers of Venice, begun in 1350 and finished in 1442. Its variegated walls of marble and its colonnades make it one of the most striking sights of the city. It is famous for its carvings and paintings. The halls of the interior are adorned with works by Titian, Tintoret, Veronese, and other Venetian masters.

**Dogger**, *dōg'gēr* (from Dutch "dogger," a codfish), a Dutch vessel equipped with two masts, and somewhat resembling a ketch. It is principally used for fishing in the North Sea, chiefly on the Doggerbank.

**Doggerbank**, an extensive sand-bank of the North Sea, between England and Denmark. It is celebrated for its cod fishery.

**Doggett's Coat and Badge**, a prize for a rowing-match on the Thames, which takes place every year on 1 August, the course extending from London Bridge to Cadogan Pier, Chelsea. The first prize is an orange-colored waterman's coat and a silver badge representing the white horse of Hanover, and to this have been added other prizes, the first prize being also augmented. The match is open to six young watermen recently out of their apprenticeship. It was instituted by Thomas Doggett, a native of Dublin, and a popular actor in the early part of the 18th century, who left a bequest for the purpose of founding the prize in commemoration of the accession of George I. (1 Aug. 1715). Dibdin's ballad opera, 'The Waterman,' is based upon this rowing contest.

**Dogma**, in the theological sense of the word, is a tenet of faith given in the word of God whether written or traditional and proposed by the Church to the belief of the faithful. Primarily the term dogma, being derived from the Greek verb *δοκεω*, to seem, to appear, meant only opinion; but in the ancient schools of philosophy dogmata (plural) were the doctrines of the several heads of such schools. The disciples of Pythagoras accepted on the authority of The Master, as they styled him emphatically, the tenets he proposed, the sufficient ground of the disciples' belief being that *αυτος εφη* "He said it." Perhaps the first employment of dogma, dogmata in the now current meaning of the word, is found in a work by St. Ignatius, disciple of St. John the Evangelist, who in an epistle to the Magnesians exhorts them to be "established in the dogmata of the Lord and the apostles." The dogmas of the Roman Catholic Church purport to have been taught by the apostles and to have been by them handed down  *viva voce* or in writing, to their contemporaries and successors, who in turn did and still do the like: that tradition is the foundation of all the Church's articles of belief. The Church has no power to frame new dogmas, and she must to the end of time proclaim the self-same dogmas which at any time in her history were authentically set forth as truths of divine revelation. What the Church may do and has done is to define, as occasion may require, the precise meaning of her teachings, bringing out into definite shape what before was not expressed with all necessary fulness or clearness. An example of this is had in the application of the term transubstantiation to signify what the Catholic Church had at all times believed and taught—that the bread and wine are, in the sacrament of the Eucharist, really and substantially changed into Christ's body and blood.

**Dogmatics**, a systematic arrangement of the articles of Christian faith (dogmas), or the branch of theology that deals with them. The first attempt to furnish a complete and coherent system of Christian dogmas was made by Origen in the 3rd century, who was followed by St. Augustine in the 4th century. Among Protestants, Melancthon was the first who wrote a compendium of the Christian doctrine.

**Dog's-fennel**, a plant (*Anthenus coluta*) belonging to the natural order *Compositæ*, and *camomile* genus. It is found in fields and waste places throughout North America, except in the Arctic regions, having been naturalized from Europe. It is known as a weed in Asia, Africa,

## DOGS — DOLBEAR

and Australia. It derives its name of dog's-fennel from the resemblance of its leaf to fennel, and from its bad smell. It has an acrid taste and emetic properties. This plant is also called "stinking May-weed," the scentless May-weed, or wild camomile (*Matricaria inodora*). The name dog's-fennel is sometimes applied in America to a species of the genus *Eupatorium*, hog-weed.

**Dogs, Isle of**, a peninsula of London extending into the Thames opposite Greenwich. The Millwall docks are on this peninsula. The king's hounds were formerly kept here, hence the name.

**Dog's-tail Grass**, so called from the resemblance of the spike to a dog's tail. (Lat. *Cynosurus*), a genus of four or five annual and perennial grasses, with flat leaves, native to the north temperate regions of the Old World. One of these grasses has been introduced into this country and is sparingly established. Crested dog's-tail (*Cynosurus cristatus*) is a slender, erect perennial growing from one to two and a half feet high, with narrow leaves and a rather slender, erect, spike-like panicle. It is valuable for lawns, constituting a large proportion of the sward of some of the best bowling greens of England. Its close, compact sod makes it an excellent pasture grass, especially for sheep. Its nutritive value is high, but its yield is low, and its tendency to seed itself in districts where it will grow, to the exclusion of more profitable grasses, and the objection of animals to its wiry flower-stalks, together with the high price of seed, will no doubt restrict its usage by American farmers. It will grow on thin soils, in a humid climate, but prefers a rich moist soil. It grows well in the shade and flowers from June to August. The seeds are small, shining and yellow, and impurities are readily recognized. The mature flower-stalks are valuable, being used in the manufacture of Leghorn hats.

**Dog's Tongue**, a biennial plant, *Cynoglossum officinale*, belonging to the *Boraginaceæ*, Borage family. It grows on waste ground and pastures.

**Dogtooth**, in architecture, an ornamented molding used in early mediæval times in the form of a four-leaved flower, with teeth projecting in the centre; also a steel punch used in working marble.

**Dogwatch**, on shipboard, a name given to each of two watches of two hours each instead of four, adopted for the purpose of varying the hours of watches kept by each part of the crew during the 24 hours. The watches are arranged thus: 8 to 12 P.M.; 12 to 4 A.M.; 4 to 8 A.M.; 8 to 12 A.M.; 12 to 4 P.M.; 4 to 6 P.M., dogwatch; 6 to 8 P.M., dogwatch; 8 to 12 P.M., and so on.

**Dogwood**, the common name of the *Cornaceæ*, a natural order of plants, either shrubs or trees, with three or more entire leaves at a node, and polygamous or dioecious flowers in cymes, but sometimes solitary. The fruit is a drupe. The family numbers about 16 genera, and 85 species, most numerous in the northern hemisphere. Of the genera, two are found in America. *Cornus*, the typical genus of the order, has 25 species natives of the northern temperate zone, Mexico, and parts of Peru, 18 of which are found in America. To this genus

belong the American shrubs and trees, known as cornel (q.v.), dogwood and kinnikinnik. The other American genus is *nyssa* (q.v.), which includes the trees called pepperidge, sour-gum, and tupelo. The wood of *C. florida* is smooth, white and fine-grained, and is used for inlaying, and from the bark a febrifuge is made. The southerners who "dip" snuff, use the small branches of the tree to make the brush with which the snuff is applied. The common dogwood of Europe (*C. sanguinea*) is a shrub of remarkable beauty in autumn owing to the deep redness of its foliage. The wood makes the very best charcoal for gunpowder. It is very hard, and is made into skewers, cogs for wheels, etc., and in former times it was in request for making arrows. The small bitter fruit yields as much as one third of its weight of an oil resembling that of olive. The wood of *Rhamnus frangula*, the berry-bearing alder, is also used by gunpowder-makers, and called by them dogwood. Jamaica dogwood (*Piscidia erythrina*) is a papilionaceous timber-tree; the cortex of the root is powerfully narcotic, used for stupefying fish or deadening the pain of toothache.

**Dohnanyi, dō-nōn'yē, Ernst von**, Hungarian composer: b. Presburg 1877. While a pupil at the Royal Conservatory at Budapest 1894-7 he took several prizes for composition. In 1897 he studied with D'Albert to perfect himself in the technique of the pianoforte previous to touring the chief cities of Austria, Germany, and England. His tours of America in 1900 were successful. His pianoforte concerto in C minor took the Rosendorf prize, Vienna, March 1899. This he played with the Boston Symphony Orchestra.

**Dohrn, dōrn, Anton**, German zoologist: b. Stettin 29 Dec. 1849. He studied at Königsberg, Bonn, Jena, and Berlin, lectured for a time on zoology at Jena, and in 1870 he founded the great zoological station at Naples. As an embryologist he has devoted himself mainly to the development of insects and crustaceans; and besides reports, he has published works on the origin of the vertebrates.

**Doit**, a small copper coin anciently current in Scotland, and equal in value to one twelfth (according to others, one eighth) of a penny sterling. There was also in lower Germany a small coin called *deut*. In the Netherlands the coin is called *duyt*.

**Dolabella, dōl-a-bēl'a, Pub'lius Cornel'ius**, Roman leader: b. about 70 B.C.; d. 43 B.C. He married Cicero's daughter Tullia, but treated her so harshly that she was ultimately obliged to leave him. He possessed considerable talents, and at one time stood high in the opinion of Cicero, though there is reason to suppose that Cicero valued him chiefly for the assistance he expected him to give against Cæsar and his party. When disappointed in this expectation his eyes were opened, and he spoke of him with the utmost bitterness and contempt. Dolabella, when about to fall into the hands of his enemies, was slain at his own request by one of his soldiers.

**Dolabra, dō-lā'bra**, the Latin name for a Celt. See CELTS.

**Dolbear, Amos Emerson**, American educator and inventor: b. Norwich, Conn., 10 Nov. 1837. He was graduated at Ohio Wesleyan

University in 1866 and has been professor of physics and astronomy in Tufts College since 1874. He has achieved eminence in scientific research, and among his numerous inventions are the writing telegraph (1864), the electric gyroscope (1867), the magnetic telephone (1876), the static telephone (1879), and the air-space telegraph cable (1882). Among his discoveries are the convertibility of sound into electricity (1873), wireless telegraphy (1881), and electric photography (1893). He has received several medals, including a bronze medal for an acoustic apparatus at the Centennial Exposition, Philadelphia, 1876, a silver medal in Paris 1881, and a gold medal in London 1882. Among his published works are: 'Chemical Tables'; 'The Art of Projecting'; 'The Speaking Telephone'; 'Matter, Ether, and Motion'; 'Modes of Motion'; and 'Natural Philosophy.'

**Dolce**, dōl' or dōl'chā, or Dolcemen'te, in music, an instruction to the performer that the music is to be executed softly and sweetly.

**Dolci**, dōl'chē, Carlo or Carlino, kār-lē' nō, Florentine painter: b. Florence 25 May 1616; d. there 17 Jan. 1686. His works, which consist chiefly of madonnas and saints, exhibit the character attributed to him. The faces are full of a pleasing and tender softness, which, however, is often carried so far as to rob them of all character. Dolci's drawing is generally correct, his coloring exquisitely delicate and transparent, and in the nicety and laborious care of his finish he approaches the most characteristic examples of the Dutch school. His works are numerous and scattered over all Europe. Besides his madonnas his most famous works are his 'St. Cecilia'; 'Christ Blessing the Bread and Wine'; and 'Herodias With the Head of John the Baptist.'

**Dol'cinites** (from Dolcino, their founder), a Christian sect which arose in Piedmont in 1304. See APOSTOLIC BRETHERN.

**Dol'drums**, a nautical term for the parts of the ocean near the equator that abound in calms, squalls, and light baffling winds; otherwise known as the horse-latitudes; also applied to the weather variations characteristic of those regions. See CALMS, REGION OF.

**Dole**, Charles Fletcher, American Unitarian clergyman: b. Brewer, Me., 17 May 1845. He is a brother of N. H. Dole (q.v.). He has been pastor of the Unitarian Church, Jamaica Plains, Boston, from 1876. He is the author of 'The Citizen and the Neighbor'; 'Jesus and the Men About Him' (1888); 'A Catechism of Liberal Faith' (1895); 'The American Citizen' (1891); 'The Coming People' (1897); 'Noble Womanhood' (1900), etc.

**Dole**, Nathan Haskell, American writer: b. Chelsea, Mass., 31 Aug. 1852. He was graduated from Harvard 1874, and was literary and musical editor of the Philadelphia Press until 1887, when he became literary adviser to the publishing firm of T. Y. Crowell & Company. His principal original works are: 'Young Folks' History of Russia' (1881); 'A Score of Famous Composers'; 'Not Angels Quite'; 'On the Point' (1894); 'The Hawthorn Tree' (1895); 'The Mistakes We Make' (1898); and 'Omar, the Tent-Maker' (1898). In 1899 he edited the complete works of Count Tolstoi, whose novels, 'Anna Karenina,' 'War and Peace,' and many others he had already translated. He has also

translated 'Maria y Maria,' 'Maximina,' and 'Sister St. Sulpice,' from the Spanish of Valdes, as well as various works from the French and German. In 1896 he edited a multivarium edition of the 'Rubaiyat of Omar Khayyam,' containing many translations in English, French, German, Italian, Hungarian, and Danish carefully collated.

**Dole**, Sanford Ballard, Hawaiian politician: b. Honolulu, Hawaii, 23 April 1844. He studied law in Boston and was admitted to the bar in 1873, returning in the same year to Hawaii. In 1884 he was made a member of the legislature and again in 1889. He had been, in 1887, appointed an associate judge of the supreme court, under the monarchy, which post he resigned to accept the leadership of the revolution that overturned the monarchy in January, 1893, and established a provisional government. On 4 July 1893 a republic was formally proclaimed, of which he was elected president. After the annexation of Hawaii in 1898 he was appointed governor of the islands.

**Dôle**, dōl, France, town in the department of Jura, 26 miles southeast of Dijon. The manufactures are Prussian blue, hosiery, ironware, leather, vinegar, optical instruments, etc.; and the trade is chiefly in grain, flour, timber, wine, brandy, coal, iron, mill-stones, and marble. It possesses many ruins of Roman architecture. Pop. 12,750.

**Dolerite**, dōl'ēr it, the name given to a class of rocks, including dolerite proper, basalt, and a few others. Dolerite itself consists of Labrador felspar and augite, with some titaniferous magnetic iron ore, and other minerals. It has a dark-gray color, crystalline, and small-grained, sometimes porphyroidal. Its specific gravity is 3. Its average composition is silica 50, alumina 15, oxide of iron 15, lime 10, magnesia 5, and the rest potash, soda, and water. It is found in great mountain masses, in beds and veins, in the Rhine district, in Iceland, in Guadeloupe, and other places.

**Dolet**, dō'la'', Etienne, a well-known French scholar and martyr: b. Orleans, France, 1509; d. Paris 3 Aug. 1546. At the age of 12 Dolet went to the University of Paris, where his attention was directed to the study which became the chief interest of his life—the writings of Cicero. In 1544, he was found guilty of heresy on a charge mainly based on an alleged mistranslation of Plato, in which he was accused of denying the immortality of the soul. After two years' imprisonment, Dolet was burned in the Palace Maubert, Paris. See Boulmier, 'Etudes sur le XVIème siècle: Etienne Dolet' (1875); Christie, 'Etienne Dolet, the Martyr of the Renaissance' (1899).

**Dolgoruky**, dōl'gō-roo'kē, Katharina Michailow'na, Princess, the favorite of the Czar, Alexander II., who married her in July 1880 after the death of his first wife, Marie. After the czar's death she lived abroad, and published in Geneva in 1882, under the pseudonym of VICTOR LAFERTÉ, 'Alexander II., Unedited Details of His Private Life and His Death.'

**Dolichocephalic**, dōl'i-kō-se-fāl'ik (from Gr. *δολιχός* long, *κεφαλή* a head); long-headed: a term used in ethnology to denote those skulls in which the diameter from side to side is



## DOLICHOPODIDÆ — DOLLART

less in proportion to the longitudinal diameter (that is, from front to back) than 8 to 10. This form of skull is seen in an exaggerated form in native Australians and West Africans. The dolichocephalic skull of ordinary type appears among Indo-European races.

**Dolichopodidæ**, *dol'ī-kō-pōd'ī-dē*, a numerous family of the order *Diptera*. They are small, metallic blue or green flies with slender legs and active habits. The larvæ live in the ground or in decomposing matter. They are not known to be harmful, but the flies are predaceous, and by this habit are beneficial to agriculture, catching, as they do, insects, and even worms, that are injurious to growing crops.

**Dolichos** (Gr. *δολυχός* long, that is, in pods), a genus of tropical herbs and shrubby plants of the natural order *Leguminosæ*. The 40 or 50 species, of which few are cultivated, are separated from species of the related genus *Phaseolus* by technical characters. The best known species are *D. lablab*, the hyacinth bean, a native of the tropics. It often twines around supports to a height of 20 feet, bears broad, often wrinkled leaves, purple, rather large flowers in erect, axillary racemes, and flat, rather smooth pods containing several small, black seeds. It is an annual, frequently planted in sunny situations to form temporary screens and arbor covers. It succeeds well in any good garden soil, but attains the greatest growth and bears the most foliage upon rich soils. It has several horticultural varieties. *D. sesquipedalis*, the French half-a-yard-long or asparagus bean, a native of South America, is cultivated for its green pods and mature seeds, which are used as esculents. The plant is an annual, twining or rambling plant, with rather large leaves and flowers and very long pods containing numerous small, oblong, usually reddish seeds. The pods sometimes exceed two feet in length and are sometimes curiously twisted. Several other species are used in Asia for food, but the two mentioned are the only ones of importance in the United States. See **SOY BEAN**.

**Doll**, a favorite plaything of children, found in variety of form and decoration. Most of the dolls found in the stores are made in the village of Sonneberg, in the Thuringian forest, Germany. Here the industry of making children's toys can be traced back to the 17th century. Other villages in this vicinity and some towns in France and Switzerland also export large quantities of dolls to England and the United States. There are about 40 doll manufacturers in London who make dolls of a superior kind. In France expensive life-size dolls are manufactured. There are a number of doll factories in the United States, where of late years "doll shows," or bazaars, have been very popular. The phonograph doll, invented by Edison, created great interest when it was first introduced.

**Dollar** (Low German *daler*, from *thaler*, short for *Joachimsthaler*, coined 1519 from silver mines in Joachimsthal, Bohemia, and standard for weight and purity), the unit of American currency. The West India trade before the Revolution had made the Spanish dollar, more convenient than the sovereign, the real unit of trade here; and the Coinage Act of 2 April 1792, merely legalized this fact, establishing the dollar

as the unit of American currency, making it equivalent to 24.75 grains of fine gold, and authorizing the coinage of silver dollars "of the value of a Spanish milled dollar the same as is now current" (see also **CENT**), and of halves and quarters correspondent. The first actual coinage was in 1794, dollars of 416 gr., 371.25 silver, 8924 fine. The dollar of account was rated at 48. 6d. sterling, making the pound equal to \$4.44; which, as the sovereign was 113 gr. gold, was too little, and should have been \$4.565. By act of 28 June 1834, the gold in the dollar was reduced to 23.20 gr., raised 18 Jan. 1837, to 23.22, where it remains, the pound having been unchanged, has since been equal to \$4.8633. The last act made the weight of the silver dollar 412.5 gr., but raised it to 900 fine, the amount of silver remaining the same as before, 371.25 gr. On 3 March 1849, a coinage of gold dollars was authorized, weight 25.8 gr., .900 fine, 23.22 gr. pure gold; on 21 Feb. 1853, a \$3 gold piece, same fineness, 77.4 gr.; and half and quarter dollars of silver, 192 and 96 gr. respectively, but legal tender only to \$5. The act of 1873 discontinued the coinage of the silver dollar of 412.5 gr., but authorized one of 420 gr. (the "trade dollar") for the China and Japan trade. The fall in silver shortly after, however, (at this time the silver dollar was worth rather more than the gold), inflated its value and made bullion owners anxious to have their metal coined into these, and on 22 July 1876, their coinage was limited to the actual demand for export, they not being intended for internal circulation—35,959,360 were issued in all. The coinage was suspended April 1878. The act of 28 Feb. 1878, revived the coinage of the dollar of 412½ gr., and that of 14 July 1890, continued it. It is notable that many times more silver dollars have been coined since 1873 than before; up to 30 June 1872, the total number struck was only 8,045,838, while that of gold dollars was 19,015,642. The act of 14 March 1900 makes the gold dollar the standard of value in the United States.

**Dollar-fish**, a name used, particularly in Maine, for a small fish of the family *Stromateidæ*, more widely known as the butter fish or harvest fish (*Rhombus triacanthus*). It is found on the entire extent of the Atlantic coast of the United States, and is extremely abundant during the summer on the shores of the New England and Middle States. The dollar-fish is from 8 to 10 inches long, of an oval form, with a blunt snout and small mouth; the color is silvery, bluish above, beautifully iridescent when alive. Great numbers are captured in seines and pound nets and they are highly valued as pan-fish. The young have an interesting habit of swimming, several together, in the company of large jellyfishes, beneath the disks of which they seek shelter and protection. Several allied species occur on both the east and west coasts of the United States.

**Dollart**, *döl'lért*, **The**, a gulf of the North Sea, at the mouth of the Ems, between the Dutch province of Groningen and the Prussian province of Hanover. It was formed by inundations of the sea, which took place in 1277 and subsequently, overwhelming many large villages and hamlets, and destroying thousands of human beings, besides much valuable property. A

considerable extent of rich land has been regained by embankment.

**Döllinger, dël'ling-ër, John Joseph Ignatius**, German theologian and historian: b. Bamberg, Bavaria, 28 Feb. 1799; d. 12 Jan. 1890. He studied at Würzburg, took priest's orders in the Roman Catholic Church in 1822; taught for several years in the Luceum at Aschaffenburg, and in 1826 was appointed professor of ecclesiastical history and law in the University of Munich. He held this position until 1871, when he was elected rector of the university. His connection with politics began in 1845, when he represented his university in the Bavarian chamber, and in 1848 he was elected to the Frankfurt parliament by a Bavarian constituency. In the early part of his career Döllinger was the zealous leader of the Ultramontane party in Germany, and his learning as well as his faith found expression in his 'Treatise on the History of the Church' (1838); 'The Reformation, its Interior Development and its Effects' (1846-8); and 'Luther' (1851). In 1857 he visited Rome, and soon afterward it became evident that his views had undergone a change. Public announcement of this was made in a course of lectures which he delivered at Munich, in which he declared the temporal power of the Pope not an essential part of the Roman Catholic Church, and he expounded this position in a treatise on 'The Church and the Churches' (1861). This attitude of opposition became more pronounced in 1870, when he declined to accept the doctrine of papal infallibility formulated by the Vatican Council, and assumed the leadership of the Old Catholic party. As a result Döllinger was excommunicated by the Archbishop of Munich, but still retained the support of the Bavarian government. In 1874 he presided over a conference of Old Catholics at Bonn, and here he declared that he did not hold himself bound by the decisions of the Council of Trent. In his latter years Döllinger's activity as an author was shown in his 'Materials for a Life of Bellarmine' (1887), and two volumes of 'University Lectures' (1888-9). See Kobell, 'Ignaz von Döllinger, Erinnerung' (1891); 'Life,' by Friedrich (1899-1901). See OLD CATHOLICS.

**Dolliver, Jonathan Perkins**, American lawyer and politician: b. near Kingwood, Preston County, W. Va., 6 Feb. 1858. He was graduated at West Virginia University 1875 and admitted to the bar 1878. He practised law in Iowa and was a member of Congress from that State for several successive terms. He was appointed United States senator to fill a vacancy and was elected in 1903 for the term ending 1909.

**Dollman, John Charles**, English artist: b. Hove, 6 May 1851. He was educated in the Royal Academy Art Schools and received a bronze medal at the Paris Exhibition in 1900. Among his works may be named: 'Not Worth Powder and Shot'; 'Warranted Quiet to Ride or Drive'; 'Judas'; 'Gold'; 'Temptation of St. Anthony'; 'Kismet.'

**Dollond, John**, English optician of French descent: b. London 10 June 1706; d. there 30 Nov. 1761. He devoted his attention to the improvement of refracting telescopes, and succeeded in constructing object-glasses in which the refrangibility of the rays of light was corrected. Subsequent members of his family have

distinguished themselves in optics, astronomy, etc.

**Doll's House, The**, one of the best known plays of Henrik Ibsen, published in 1879. It pictures woman as a doll, from whom nature has removed the unused faculties which produce clear thinking and business-like action. Nora, the doll in question, is sweet, childish, ignorant. For the sake of her husband she forges her rich father's name without realizing her guilt. Disclosure of her act brings her face to face with the realities of life, and she leaves her husband's house. An English version of the play was produced in London in 1889.

**Dolly Varden**, the soft-hearted, wily little coquette in Dickens' novel 'Barnaby Rudge.' The impression made by the author's description of her dress of flower-sprinkled dimity led to the adoption of a style of dress that is known as the Dolly Varden. The name is often applied to any light dress-goods with bright-colored flower effects.

**Dolly Varden Trout**, the common brook trout (*Salvelinus malma*), of western North America, so called because of the beauty of its markings, which are said to resemble the coloring of a Dolly Varden (q.v.) dress. The trout often attains a weight of 12 pounds. In the region of its native waters it is known as the bull-trout, red-spotted trout, and malma. It has been used to stock streams in the northeastern States, Canada, and Europe.

**Dol'man**, a long robe worn by the Turks as an upper garment. It is open in front, and has narrow sleeves buttoned at the wrist. It has given its name to a kind of loose jacket worn by women as an outer garment. It has a cape or hanging piece over the arm instead of a sleeve.

**Dol'men**, a structure consisting of one large unhewn stone, resting on two or more unhewn stones, placed erect in the earth. The name is sometimes used as equivalent to cromlech, sometimes in a distinctive sense. Sir John Lubbock maintains that cromlech should be applied to a stone circle, dolmen to a stone chamber, such circle or chamber consisting of huge stones set up often in prehistoric times for religious or sepulchral purposes or as memorials of some important event.

**Dolnja Tuzla, döl'nyä tooz'tä**, Bosnia, town about 20 miles from the Servian frontier. Pop. 10,227.

**Dolomieu, Déodat Guy Silvain Tancrède Gratet de, dā-ō-dā gē sil-vān tăn krād grā-tā dē do-lo-mē-ē**, French geologist and mineralogist: b. Dolomieu (Isère) 24 June 1750; d. Chateaufort, France, 26 Nov. 1801. He was appointed correspondent of the Academy of Sciences of Paris, and from 1777 to 1791 made extensive travels in the south of Europe, often on foot, with a hammer in his hand and a bag on his back. In 1796 he was appointed professor or lecturer in the School of Mines, and on the establishment of the Institute was made a member of that society. In 1801 he received the professorship of mineralogy in the museum of natural history. Among the works left by him are 'Voyages aux Iles de Lipari' (1783); 'Sur le Tremblement de Terre de la Calabre' (1784); 'Philosophie Minéralogique' (1802).

## DOLOMITE—DOMAIN

Dolomite, carbonate of calcium and magnesium ( $\text{Ca,MgCO}_3$ ) containing normally 30.4 parts lime and 21.7 parts magnesia, but varying in the ratio of the two carbonates. Iron and manganese carbonates are sometimes present as impurities. The crystallization is rhombohedral; the hardness 3.5 to 4; specific gravity 2.8. The color is normally white but may be reddish, grayish, brownish, or even black. In general the mineral resembles calcite but differs in not effervescing freely with cold acid, even if finely powdered. Massive dolomite in the form of dolomitic limestone is a rock of common occurrence and sometimes forms strata of great extent and thickness. Such limestones frequently show all transitions from nearly pure calcite to true dolomite. Generally, a limestone containing over 5 per cent  $\text{MgO}$  is described as a magnesian limestone. Under pressure dolomitic limestones and dolomites become crystalline and are classified as marbles. Many of the great limestone formations in the United States are more or less dolomitic. See DOLOMITIZATION; LIMESTONE; ROCKS.

**Dolomite Mountains**, or **Dolomite Alps**, a group of mountains, part in Tyrol and part in Italy. The name comes from the mineral dolomite, found in large quantities in these mountains.

**Dolomitization**, the process by which the calcium in limestones is replaced by magnesium, forming dolomitic limestones and dolomites. The exact nature of this process is still a matter of doubt. Dolomites cannot be formed directly from the calcareous remains of animals, since they contain a much larger proportion of magnesia than any animal shells or tests, and the magnesium therefore was probably added after the calcareous material had accumulated. In the lagoons of coral reefs, the enclosed body of sea water becomes concentrated by evaporation, and the chloride of magnesium (present in all sea water) by a process of double decomposition forms magnesium carbonate from the calcium carbonate of the coral rocks. It is also possible that fine calcareous mud in suspension in sea water may exchange some of its calcium directly for magnesium. See DOLOMITE.

**Dolores**, dō-lō'rēs, **El Grito de**, literally, "The cry, or outcry, of Dolores," marking the commencement of the Mexican war for independence. On the night of 16 Sept. 1810, Don Miguel Hidalgo y Costilla, the parish priest of the town of Dolores (q.v.), gathered a number of patriots under his banner to the cry of: "Long live religion! Long live our Most Holy Mother of Guadalupe! Long live America, and death to bad government!" All previous attempts (1798-1810) to rebel against the Spanish authorities had been suppressed; but Hidalgo and his enthusiastic followers were victorious in several engagements. Although he and his lieutenants, Allende, Aldama, and Jimenez, were captured and put to death in 1811, the movement they began was carried on until the revolutionists triumphed, 27 Sept. 1821, Yturbide entering the capital on that day. See MEXICO.

**Dolores Hidalgo**, ē-dāl'gō, Mexico, a town in the state of Guanajuato, department of Allende, about 41 miles from the capital of the state, which is also called Guanajuato. Pop. 6,000.

**Dolph**, John Henry, American painter: b. Fort Ann, N. Y., 18 April 1835; d. New York, 28 Sept. 1903. He studied at Antwerp, and in Paris, then opened a studio in New York; he was a member of the National Academy. His works include: 'Knickerbocker Farm Yard'; 'Season of Plenty'; 'Horse Doctor'; 'A June Day'; 'Who Will Bell the Cat'; 'Cat and Kittens'; 'A Princess'; 'Fish Commissioners'; 'Alexander and Diogenes'; 'The Waste Basket'; 'A Society Lion'; and 'Called to Order.' His pictures of animals, and particularly cats, are best known.

**Dolph**, Joseph Norton, American statesman: b. Dolphsburg, N. Y., 19 Oct. 1835; d. Portland, Ore., 10 March 1897. He studied law, and began practice at Binghamton, N. Y. In 1862 he settled in Portland, Ore., taking up the practice of law there. In 1864 he was elected city attorney, and was appointed United States district attorney. He was a member of the State Senate four consecutive terms, was elected to the United States Senate in 1883, and re-elected in 1889. In his second term he was chairman of the Committee on Coast Defenses, a member of the Committee on Commerce, and an active opponent of the free coinage of silver.

**Dolphin**, a group of cetaceans belonging to the family *Delphinidae*. The common species (*Delphinus delphis*) is found chiefly in the Mediterranean and North Atlantic Ocean. It is from six to eight feet long; the body tapers toward the crescent-shaped tail, which is about a foot broad. The blow-hole is also crescent-shaped; and the beak is usually about six inches long. The dolphin is blackish on the back, and white below, the sides being gray. The female produces but one at a time, and devotes herself assiduously to caring for it. There are numerous species of dolphin, each confined, apparently, to a comparatively narrow range. All are voracious, and feed on other fish and various marine animals, eating, it is said, even the disabled and feeble of their own kind. They live in herds or "schools," and may be seen by ocean voyagers playing about the vessels. They will leap in graceful curves, into the air, make sudden descents into and through the waves, followed by a track of foam. Then they will re-appear, show their slender back-fins, expose their broad tails as they plunge below the water; and almost before one has missed them, they will rise on the other side of the ship. They are a source of pleasure to the ocean traveler; and furnish more substantial gratification to the sailors, who eat their flesh with much relish after their usual rations of salt-pork. The grampus, the porpoise, and many of the so-called whales, such as the white-whale, the killer-whale, and others, are related genera; as are also the soosoo of the Ganges, and the boto of the Amazon, which inhabit fresh water instead of the ocean. Consult Beddard, 'A Book of Whales' (1900).

**Domain**, from the Latin *dominium*, right of ownership, property, dominion. The territory over which dominion is exercised; the territory ruled over by a sovereign, or under the government of a commonwealth, as the domains of Great Britain. The term public domain is used in Europe, as property belonging directly to and controlled by the state; such as lands

## DOMBEY AND SON — DOMESTIC SCIENCE IN SCHOOLS

set apart for state or public uses, roads, canals, parks, etc. In the United States the lands owned by the Federal government or by a State.

**Dom'bey and Son**, a novel by Charles Dickens, published in 1848. It represents a man of proud and unbending nature who centres his worldly ambitions in an only son, but who becomes broken and subdued by his child's death, family disgrace, and financial ruin.

**Domboc**, dōm'bōk, or **Doom-book** (A. S. "book of dooms or sentences"), the code of laws compiled by King Alfred, who made few if any original laws, but contented himself with restoring, renovating, and improving those which he found already in existence. Alfred's religious character is strongly impressed on his code, which begins with extracts from the Bible. Then follow the Ten Commandments, the part of the Mosaic law relating to criminal offenses, and passages from the New Testament, including the Golden Rule. The code was ratified by the Witan, as Alfred expressly informs us. Thorpe gives it in his "Diplomatarium Anglicanum ævi Saxonici" ('English Diplomatarium of the Saxon Era') (1865).

**Dombrowski**, Jan Henryk, yān hēn'rik dōm-brōf'skē, Polish general: b. Pierszowice near Cracow, 29 Aug. 1755; d. Wina-Gora, Prussia, 6 June 1818. After serving under the Elector of Saxony he returned to take part in the Polish campaigns against Russia and Prussia in 1792-4. Next entering the French service, he organized a Polish legion at Milan; and in the campaigns which followed, Dombrowski and his Poles took a distinguished part. After the fall of Napoleon he returned to Poland and was appointed by the Emperor Alexander a general of cavalry and Polish senator.

**Dome**. See CUPOLA.

**Dome of the Rock**, a name given to the Mosque of Omar, Jerusalem. It stands on Mount Moriah, on the site once occupied by the Temple of Solomon. Immediately under its dome is an irregular-shaped rock. This rock was the scene of many scriptural events, and has been greatly revered for ages. See JERUSALEM.

**Domenichino**, dō'mā-nē-kē'nō, or **Domenico Zampieri**, Italian painter: b. Bologna 28 Oct. 1581; d. Naples 15 April 1641. He was sent to study first with Calvart, and afterward with the Carracci. From the slowness of his execution he was named, by his fellow-students, the "ox of painting"; but Annibal Carracci predicted that the ox would "plough a fruitful field." Having contracted a great friendship for Albano he joined him at Rome, and his former master, Annibal Carracci, jealous of Guido, procured for him the execution of one of the pictures for a Roman Catholic church which had been promised to that great painter. It was a custom with Domenichino to assume, for a time, the passion he was depicting; so that, while working by himself, he was often heard to laugh, weep, and talk aloud, in a manner that would have induced a stranger to suppose him a lunatic. The consequence, however, was, that few painters have surpassed him in lively representation. His 'Communion of St. Jerome' has been considered, by some connoisseurs, inferior only to the 'Transfiguration' of Raphael; and the 'History of Apollo,' which he painted

in 10 frescoes for Cardinal Aldobrandini, is also much admired. His merit excited so much envy that he retired to his native city and employed himself two years on his famous picture of the 'Rosary.' He was afterward recalled to Rome (1621) by Gregory XV., who created him his first painter and architect of the Vatican. Losing this post after the Pope's death, he accepted an invitation to Naples, to paint the chapel of St. Januarius. But here he encountered a jealousy so rancorous that his life became altogether embittered by it; and so great was his dread of poison, that he prepared all his eatables with his own hand. Domenichino, who understood every branch of his art, produced nothing excellent without study and labor; but in consequence of his great premeditation, no painter has given his pieces more of the properties belonging to the subject. At the same time his designs are correct; and he succeeded equally in the grand and the tender. Nearly 50 of his pieces have been engraved.

**Domestic Animals**. See DOMESTICATION.

**Domestic Science in Schools**, the branch of study that is concerned with household economics as a part of the school curriculum. The introduction of manual training into American public schools naturally led to the development of sewing and cooking as branches of study for girls, and courses of this kind have been established in the grammar schools and high schools of many of the large cities throughout the country. In many cities there are manual training high schools with domestic science as a strong feature. The manual training high school of Kansas City offers domestic art as an elective, and was able in 1902-3 to accommodate 650 girls in one-, two-, and three-year classes. Downer College, Milwaukee; the State College of Agriculture, Ames, Iowa; the Minnesota State Agricultural College; the State Normal School at New Paltz, N. Y.; are only a few of the many institutions where a thorough training is offered. In New York the following institutions are teaching domestic science in all or part of its phases: Teachers' College; the Manhattan Trade School for Girls; the Girls' Technical High School; Pratt Institute, Brooklyn; the Hebrew Technical School for Girls; and the evening public schools of Manhattan, Brooklyn, and Queens.

A normal course in domestic science covers three years. The work of the first year includes psychology, history of education, chemistry, physiology, drawing, cord-work, weaving, basketry, sewing, cooking, and physical training. At the end of the first year the student is able to decide whether she is best qualified to teach domestic science or domestic art. If the latter specialty is preferred she takes advanced sewing, dressmaking, millinery, drawing, water color, design, history of costume, embroidery, normal methods, and bacteriology. Into such training embroidery as mere fancy-work does not enter; art principles and educational significance being determining factors, and individuality being demanded in the student's work. She must be something more than a skilful needle-woman.

The same philosophical attitude is preserved in the teaching of cookery, and the young woman trained in these normal classes is not a simple cook; she is a chemist and a dietary expert, understanding both the theory and the practice of

## DOMESTICATION—DOMICILE

her art. It is evident that educators do not view the subject from a merely utilitarian view-point. The educational value of domestic science and art are recognized and emphasized. As instructors in these branches, women of sound education and thorough professional knowledge are required. Schools and colleges in all parts of the country are demanding such teachers; and the vacation schools, settlements, and other institutions of all large cities in the East claim a large number of them. One sphere which is opening to women with such qualifications is that of the dietary expert in penal and philanthropic institutions. A field so large as that offered to graduates of schools of domestic science and art will not soon be overcrowded.

**Domestication**, the modification of animals by deliberate interference with their food and surroundings, with the work of functions they perform, but especially with their breeding. Man has exterminated some animals—for example, birds, and propagated others—for example, fishes; he has made many become rare, shy, and cunning, while others (for example, dogs and cats) find shelter in his dwellings; he has kept some captive, like the fish in the pond; tamed others for his service, like horses and oxen; he has preserved some artificially from their enemies, because of their rarity, and others because of their utility. When a distinct breed has been produced by human interference, in most cases deliberately by artificial selection, we call the result domestication. Strictly “domesticated animals” correspond to strictly “cultivated plants”; in both cases the organisms have been modified, more or less fixedly, from their natural or wild state, by changes in food and environment, function, and breeding.

Domestication began long before the dawn of history (see AGRICULTURE; ANTHROPOLOGY; DOG). Among lower animals, silk-moths (see SILK) and hive bees (q.v.) have been for long controlled, and to a limited extent modified. Among fishes, gold-fish (q.v.) may certainly be regarded as domesticated for decorative purposes. Birds include many illustrations of domestication—pigeons, fowls, ducks, geese, peacocks, turkeys, guinea-fowls, canary-birds, etc. Among mammals, dogs and cats, horses and asses, cattle, sheep and goats, elephants, camels, reindeer, pigs and rabbits, etc., have been domesticated, and have given rise to many different breeds. The complete list is not a long one, yet probably it will not be increased. To admit of domestication, animals must generally be social and docile in their habits, and must be capable of retaining fertility under changed conditions.

The process of domestication, as far as deliberate control is concerned, is for the most part equivalent to selective breeding. Different breeds differ from natural species in being usually mutually fertile. In other words, while two domestic races may be externally more different than are two nearly related species in nature, the reproductive elements in the first case cannot differ as they must do in the second. Thus crossing is usually successful between domestic breeds, only rarely between adjacent natural species. When we pass beyond selective breeding to inquire into the conditions of variation, a much more difficult problem is raised. In regard to some changes which crop

up in domestic animals, we cannot do more at present than refer them to variations in the unstable germ-cells, and to the intermingling of sexual reproduction. Where the intercrossing is regulated, the importance of the latter is especially obvious. These germinal changes may, however, as the organism grows, find expression in the continually variable rhythm between nutrition and reproduction, between growth and multiplication—the great antithesis of organic life. But while considering this internal aspect, we have at the same time to recognize the importance of external influences, especially of altered climate and diet. These hinder or abet the constitutional or inherited tendencies, and may in course of time bring about important new results. Domesticated forms are more variable than their wild relatives; the males are more variable than the females; and the offspring of hybrids are more unstable than the hybrids themselves.

The results of domestication are very varied. Sometimes the changes induced and cultivated have been comparatively slight, in other cases they have amounted to the evolution of new species. These changes are abundantly illustrated in Darwin's classic work on variation under domestication.

**Domett**, dōm-ēt' or dōm'ēt, Alfred, English poet: b. Camberwell, Surrey, England, 20 May 1811; d. London 12 Nov. 1887. He was the original of Browning's 'Waring.' He lived in New Zealand, 1842-71, and became a colonial statesman of eminence. His verse attracted much attention, the best specimens being in the volumes 'Ranolf and Amohia' (1872); and 'Flotsam and Jetsam: Rhymes Old and New' (1877). See Gisborne, 'New Zealand Rulers and Statesmen' (1897).

**Domicile** is the permanent, fixed home of a person, with no present intention of removing therefrom. A person traveling from one city, State, or country into another does not change his domicile and create a new one at every place he stops, but the place to which he intends to return and reside permanently is his domicile. Generally speaking, a person can have but one domicile at one time; but for different purposes, he may have more than one domicile at one time. Some things for which it is necessary to have a domicile are: administration of a person's estate, jurisdiction, taxation, and homestead exemptions. In America, the place at which a person exercises his political rights, and privileges, and which he calls his home, is considered his domicile. The two things necessary to a domicile are an actual residence and a present intention of remaining there.

After a person has once acquired an actual domicile, he does not lose it by a temporary absence, no matter how long it is continued, if he intends to return; and in cases where a person changes his domicile he does not lose the old place of domicile, until he has actually acquired the new one. While the intention of the person enters into the question of domicile, it is not a controlling feature; and in a change of domicile the intention must be reinforced by some act, such as exercising a political right, engaging in business, paying taxes, and executing a will, according to the laws of the place; all of which are evidence of the intention to create a new domicile. When persons are mar-



## DOMINANT — DOMINICA

ried, the wife acquires the domicile of her husband; and all children born acquire the domicile their father had at the time of their birth. If a widow with minor children marries, the domicile of the children is not changed until there is an actual removal. Illegitimate children acquire the domicile of their mother in some jurisdictions; if acknowledged by their father, they acquire his domicile.

A person absent from home on the service of his government, such as an ambassador, consul, soldier, or sailor, does not change his domicile; unless, after the service is finished, he continues to reside at that place. A convict or prisoner, a person attending a college or university, does not change his domicile. A person may acquire a commercial domicile in a place different from that in which he lives. When a person goes to a foreign country and engages in business there, he is considered a merchant of that country; and it makes no difference what the relations of the government of the countries are with one another.

A guardian cannot change his ward's domicile from one country or State to another; and it is doubtful even if he can change the domicile from one county to another in the same State. The nature and purpose of the appointment of a guardian may, however, change the general rule. The appointment of a guardian will not prevent the ward from changing his domicile. Although the domicile of the wife is considered as that of the husband, yet in actions for divorce, a husband, after giving his wife a cause for divorce, cannot acquire another domicile so as to deprive her of that right. In wills, the law of the domicile of the testator governs as to the validity of the execution and the distribution of personal property; but as to real estate, if it is to pass under the will, the testator must execute the will according to the laws of the place where the property is situated. Corporations are considered as domiciled in the county or State from which they have derived their charters.

**Dominant**, in music, is the fifth note above the tonic or keynote of any scale. It is always major in both major and minor modes, as its harmonies rule or determine the scale. Originally so called because in the ecclesiastical system it was the principal reciting note of the Gregorian chant. It also marks the division of the scale into two co-ordinate parts, as in a fugue when the subject commences with the tonic the answer starts with the dominant, or the reverse. In the sonata form it used to be an almost invariable rule to start the second subject in the dominant key.

The *dominant chord* is the major triad on the fifth of the major or minor key. Thus of C the triad would be *g-b-d*. A *dominant seventh* is formed by adding a minor seventh to the triad. Add *f* to the dominant triad given above and you have the dominant seventh of C.

**Domingo, San.** See SAN DOMINGO.

**Dom'nic, Saint**, founder of the order of Dominicans or Preaching Friars: b. Calahorra, in Old Castile, Spain, 1170; d. Ravenna, Italy, 6 Aug. 1221. According to the legendary story of his life his future eminence in the Church was foreshown to his mother before his birth by preternatural premonition, for she dreamed that she saw a dog presenting to her child a flaming

torch with which to set the world ablaze. This explains the meaning of the dog with torch in his mouth, seen in many pictures of Saint Dominic. In childhood he gave signs of extraordinary piety and love of ascetic practices. At 17 he entered the University of Palencia (removed later to Salamanca), and devoted himself to the study of philosophy and ancient literature. Here he once sold his clothes in time of famine to obtain the means of relief for the poor; on another occasion he offered himself to be a slave to the Moors in exchange for a widow's only son. He stayed in the university 10 years, and, having been ordained priest, was made a member of the cathedral chapter of Osma, and in that station was the zealous assistant of the bishop in suppressing abuses in the Church. He accompanied this bishop on an embassy to France in 1203, and in passing through Provence was grieved by the extreme laxity of morals in clergy and laity and the alarming progress of the various Manichæan sects. Dominic vowed himself to a life of evangelical labor among those sectaries, and resolved to make all possible efforts for the correction of the evils which menaced the existence of the Church in those parts. There were already in the field legates commissioned by the Pope to win the erring back to the fold; but Dominic was scandalized by their worldly pomp, and declared that not in costly attire and with a showy retinue should they approach the misguided Albigensians and poor men of Lyons, but barefoot and without purse or scrip; and the papal envoys, persuaded by the words of the zealous evangelist, laid aside their state and for a while followed the examples of humility and zeal set by Dominic. But their preaching proving unfruitful, they retired from the field and reported to Rome their failure. Nor was Dominic himself rewarded with much success, though the annals of his life tell of great miracles which attended his progress through the country. Then resort was had to force, and a crusade against the Albigensian heretics was proclaimed; which was conducted by Simon de Montfort with extreme severity till, at his death in the siege of Toulouse, resistance on the part of the Albigenses was overcome. No proof exists that Dominic either prompted the crusade or had any part in it; but it is certain that he was a friend of Simon de Montfort and of his family. He quit the country in 1217, one year before the end of the war, and withdrew to Rome where he spent the remainder of his life in organizing the order of Preaching Friars. He arranged the prayers and meditations of the devotion called the 'Rosary,' much in use by Roman Catholics in all parts of the world. See DOMINICANS; ROSARY. Consult: Drane, 'Life of Saint Dominic'; Lacordaire, 'Vie de Saint Dominique.'

**Dominica**, döm-în-ē'kă, or **Dominique**, döm-ē-nēk', West Indies, an island in the northern half of the Caribbean chain of the Lesser Antilles. (See ANTILLES.) It is the largest of the British Caribbees, being 29 miles long, 16 miles broad, and having an area of 291 square miles; it has also the highest summit of this volcanic island chain, the Morne Diablotin (5,314 feet), several thermal springs, and an old crater-lake about 2,800 feet above sea-level which formerly "was flooded by boiling water from springs bubbling up from the bottom, and every



five minutes upheaving in a foaming geyser." The area of this lake was diminished by landslides which occurred in 1880, but it is still of great depth. The rainfall of the island is very abundant. The summer temperature is about 80° F.; that of winter, spring, and autumn about 70° F. An interesting part of the population is a group of Caribs (q.v.), though these aborigines are now largely mixed with the blacks. "They inhabit the mountains of the interior, and make their livelihood by weaving a peculiar basket which is universally used in the island for carrying baggage." The blacks referred to, descendants of African slaves of the period when Dominica belonged to France, are by far the most numerous element; they, as well as most of the white inhabitants, speak a French patois, and "still look upon the British owners as foreigners." With the exception of the Indians, the people live near the coasts. In the luxuriance and beauty of its vegetation, Dominica excels the other neighboring islands. Its soil is a rich brown mold, in which all tropical products grow readily. Of its 186,240 acres, two thirds are crown lands, but the government has utterly failed to promote agriculture, which is now nearly ruined. Exports are cattle, cocoa, lime-juice, rum, molasses, and sugar. The revenues do not equal expenditures, and taxes are increasing. Dominica is a presidency, belonging to the British Leeward Island administrative group, which includes also St. Christopher, Nevis, Antigua, Barbuda, Montserrat, Redonda, and the British Virgin islands, the seat of the Leeward government being at St. John, Antigua. The local government is conducted by a commissioner, or president, an executive council of seven members, and a legislative assembly. These officials exercise their authority at the small town of Roseau, which is situated on the western side of the island, and has wide and regularly paved, but deserted, streets, a botanical garden, a public library, and French (Catholic) and English churches. The name of the island (from Spanish *Domingo*, Sunday) is due to the circumstance that Columbus discovered it on the first day of the week, 3 Nov. 1493. The warlike Caribs retained control of it during two centuries, but little by little French settlers gained a foothold, and in the 18th century its possession was regarded as essential to the maintenance of French prestige in the West Indies, owing to its situation between the important dependencies of that country, Martinique and Guadeloupe. For that very reason the English insisted upon its surrender, in the final balancing of international accounts after the imperial wars, early in the last century. Many laborers have migrated to South America in search of employment. R. T. Hill says, in his 'Cuba and Porto Rico, with the Other Islands of the West Indies': "Formerly the slopes of Dominica were covered with coffee-trees, but this industry has practically disappeared. In 1843 there was as much as 1,333,000 pounds of coffee, besides rum, sugar, and molasses. The coffee culture even reached 2,500,000 pounds in 1828. Now the whole of this industry has vanished, except a few trees set out within recent years. Faint attempts are being made to increase the production of cocoa, limes, and lime-juice, as well as of essential oils." It would be fairer, however, to ascribe Dominica's economic decline

to the low price of both of her natural products, sugar and coffee. The population in 1881 numbered 28,211; a decade later it was only 26,841; and the exodus still continues.

**Dominical Letter** (from Lat. *Dominica*, Sunday), properly called Sunday letter, one of the first seven letters of the alphabet used in calendars to designate the Sundays throughout the year. The ancient Romans used the first eight letters, A–H, to denote their nundinal period; the early Christians dropped the eighth and adopted the remaining seven to indicate the days of the Hebrew week. These seven letters are employed to show on what days of the week the days of the month fall throughout the year. One of those seven letters must necessarily stand against Sunday, and is printed as a capital, and called the dominical letter or Sunday letter; the other six being inserted in different type, to denote the other six days of the week. Now, since a common Julian year contains 365 days, if this number be divided by seven (the number of days in a week), there will remain one day. If there had been no remainder it is obvious the year would constantly begin on the same day of the week; but since one remains, it is plain that the ordinary year must begin and end on the same day of the week; and therefore the next year will begin on the day following. Hence when January begins on Sunday, A is the dominical or Sunday letter for that year; then, because the next year begins on Monday, the Sunday will fall on the seventh day, to which is annexed the seventh letter, G, which, therefore, will be the dominical letter for all that year; and as the third year will begin on Tuesday, the Sunday will fall on the sixth day; therefore F will be the Sunday letter for that year. Whence it is evident that the Sunday letters will go annually in retrograde order, thus, G, F, E, D, C, B, A; and in the course of seven years, if they were all common ones, the same days of the week and dominical letters would return to the same days of the months. But because there are 366 days in a leap-year, if the number be divided by seven, there will remain two days over and above the 52 weeks of which the year consists. And therefore, if the leap-year begins on Sunday, it will end on Monday; and as the year will begin on Tuesday, the first Sunday thereof must fall on 6 January, to which is annexed the letter F, and not G, as in common years. By this means, the leap-year returning every fourth year, the order of the dominical letters is interrupted, and the series cannot return to its first state till after four times seven, or 28 years; and then the same days of the month return in order to the same days of the week as before. This method of indicating the days still holds its place in Church calendars without variation from the beginning.

**Dominican Republic**, West Indies, a country which occupies the eastern and central portions of the island of Santo Domingo, or Haiti: bounded on the north by the Atlantic Ocean, on the south by the Caribbean Sea, on the west by the republic of Haiti, and separated by the Mona Passage from Porto Rico on the east. Its area is commonly estimated at 18,045 square miles.

**Political Divisions**.—The country is divided into six provinces and five maritime districts, each administered by a governor appointed by

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the president; the governors, in turn, appoint the prefects who preside over communes, cantons, and sections. Principal cities and villages are: The capital, San Domingo city (q.v.), regarded as one of the most perfect specimens of a 16th century Spanish-American town, but now in decadence; Santiago de los Caballeros (q.v.), also one of the oldest places in the New World, situated in the northern plain called Vega Real, about 160 miles northwest of the capital; Puerto Plata, on the north coast, connected by rail with Santiago; Concepcion de la Vega, on the river Camu, near Santiago; Azua de la Compostella, on the south coast, about 55 miles west of San Domingo city; Samaná, on the bay of that name; Monte Cristi, on the north coast; and Seybo, 50 miles northeast of the capital. The last four are very small places, of 1,000 to 5,000 inhabitants.

*Outlying Territory.*—For adjacent islands see SANTO DOMINGO, ISLAND OF. Some of the general physical characteristics of the main island are also discussed more fully in that article.

*Topography and Physical Geography.*—The mountains—the centre and culmination of the Great Antillean uplift—form several cordilleras or roughly parallel ranges. The highest peak, Mount Tina (10,300 feet), is northwest of San Domingo city, and near the centre of the island are numerous peaks from 8,000 to 9,000 feet high. While the enormous mass of these mountains, occupying four fifths of the island, renders much of the territory nearly inaccessible, between the ranges lie plains, some of which are wonderfully fertile. Toward the north and west are the famous Vega Real and the plain called Des poblado de Santiago; near the south coast the rich valley of Baní, which extends between the Nizao and the Ocoa; and in sequence the valleys of Azua, San Juan, or Antigua Maguana, Santo Tomé, Onceano, Hincha, Quava, and others; toward the east, extending even to Cape Engaño, is a region in which the *praderas* or *llanos*—valleys, meadows, or plains—are most common. Even the ridge of the Cibao Mountains sinks to a height of only 1,000 feet at its eastern end.

*Rivers and Harbors.*—The Ozama and Isabela rivers unite to form the port of San Domingo after receiving the waters of many smaller streams, such as the Yavacao, the Monte Plata, and the Savita. The Haina, or Jaina, which empties into the sea about 10 miles west of San Domingo city, and the Nigua, whose course is still farther toward the west, enclose a very beautiful plain which was a source of wealth during the Spanish period. The Nizao flows southward between fields of sugarcane and meadows where herds of cattle graze. Other rivers are the Artibonito, Yagui, Yuna, Naranja, and Magua. The coast-line, about 940 miles in extent, includes the Bay of Samaná—a well-sheltered harbor extending westward from the Mona Passage, its average width being 12 or 13 miles and its length more than 25 miles. It has been pointed out that this bay would accommodate the largest fleets, and that defensive works placed at its entrance would make it practically impregnable; its strategic value is certainly so great that it should be reckoned one of the republic's chief assets. The other open ports are: on the north,

Puerto Plata, Monte Cristi, Macoris, and Sanchez; on the south, San Domingo city and Azua.

*Geology and Mineral Resources.*—The geology of the island, as described by Blake, Marvin, and others, is similar to that of the eastern ends of Cuba and Jamaica. There are, according to Robert T. Hill, four principal formations: "the older mountain rocks, of Cretaceous and Tertiary Age, made up of igneous rocks and clays, mantled by gravels and crystalline limestone; the white limestones of Tertiary Age; recent alluvial formations; and the coast limestone of elevated reef rock. No recent volcanic rocks are known." For the Antillean mountain system, compare CARIBBEAN SEA and CENTRAL AMERICA. It is customary to say that the mineral resources of the republic have been either neglected or exhausted; and it is, indeed, quite certain that, whereas the Spaniards obtained large amounts of gold and silver, especially the former, from the mines that were worked during the early years of colonization, recent reports made by American experts are not especially favorable with regard to these two metals. The fact, however, seems to be that gold exists quite generally, but not in paying quantities if we allow for high-priced labor. The profits of the old mines were won by the labor of native and African slaves. Copper, iron, manganese, platinum, tin, marble, antimony, and chalcodony are found; and the analogy of the Santiago de Cuba mining region would suggest that the deposits of the first three metals deserve particular attention. Valuable petroleum lands have been found near Azua.

*Soils and Climate.*—The diversities of both soil and climate are greater than elsewhere in the Antilles. Thus, the Vega Real is fertile and well-watered; the Santiago plain, its western prolongation, is a desert. The soil of the western part of the plain of Seybo is gravelly, while that of the eastern part is composed of loams and clays. The country immediately surrounding Azua is barren; but the best sugar estates on the island are only three miles away—and the sugar-lands of no other West Indian island can quite rival in fertility San Domingo's best. The heat in low-lying and sheltered districts is intense: "fatal to Europeans," says an eminent Spanish authority. At an elevation of more than 1,600 feet, the nights are cold. Coasts and plains of a moderate elevation which have the benefit of the east wind are regarded as comparatively healthful: the capital, for example, where the temperature averages 64° F. in the morning and 85° F. at noon. The climate of Santiago de los Caballeros is fairly salubrious. The arid regions are chiefly the lower slopes on the windward side of the island; in the high mountains the precipitation of moisture is excessive. The rainy season culminates in May and June.

*Forests, Flora, and Fauna.*—Cedar, *lignum vitae*, mahogany, and other cabinet-woods, as well as timber used in house- and ship-building, are taken from the forests, which also produce logwood, fustic, etc. (see list of exports): the most luxuriant growths, however, have no present commercial importance, because adequate means do not exist for bringing them from the interior regions to the coast. As in other parts of the Antilles, the forms of vege-

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table life are varied and of special interest, while precisely the reverse is true of the fauna. See SANTO DOMINGO, ISLAND OF.

*Agriculture.*—In the south and west are the principal sugar plantations; the area of tobacco is the north and some parts of the uplands of the interior; coffee grows readily in the mountain regions, and in the district of Barahona its production on a large scale has begun; the cultivation of cocoa, like that of sugarcane, has increased rapidly since about 1885; cattle raising also receives a little more attention than formerly was the case; tropical fruits, especially bananas, flourish nearly everywhere.

*Exports and Imports.*—An official résumé of the exports through the custom-houses of the republic during the first half of 1902 shows the values of the principal articles of export to have been as follows:—sugar \$1,962,814.18; cacao \$750,530.32; coffee \$188,500.00; bananas \$37,836.50; wax \$34,636.49; leaf tobacco \$26,974.07; goatskins \$22,051.56; ox-hides \$20,313.04; campeche wood \$10,730.00; mahogany logs \$8,217.52; guayacán \$7,078.32; honey \$5,056.00; divi-divi \$4,176.00; espinillo wood \$2,701.45; live animals \$2,691.00; bera \$1,971.50; mahogany forks \$1,570.00; sisal rope \$1,419.40; and, less than \$1,000 each: raw cotton, deer horns, yarey fibre, caya wood, cedar, tortoise shells, moss, molasses, mora wood, rum, and sole leather. The total value of exports in 1901 was \$5,190,036.64. Of imports, the total value in ordinary years is somewhat more than one half that of exports, the large items being cotton goods, hardware, and provisions.

*Railways, etc.*—Besides the railway referred to above, which crosses two mountain ranges and connects Santiago with Puerto Plata, another line to furnish transportation from Samaná Bay to Santiago has been built to a point beyond La Vega. There are 430 miles of telegraph, and 51 post-offices. The difficulties of communication between the various districts of the country, primarily due to the cordilleras, are in part attributable to the government's neglect to build good highways—without which peace will never be assured. Several concessions for railways were granted in 1901. The republic has regular communication with America and Europe by means of the lines of steamships calling at its ports.

*Government.*—The constitution vests the executive power in a president chosen by an electoral college for a four years' term only; both he and the vice-president, however, are eligible for immediate re-election. The congress (a single house) is composed of two members from each province and maritime district, elected by direct popular vote with restricted suffrage. The cabinet in 1902 included the following secretaries: of interior and police; of war and marine; of foreign affairs; of justice and public instruction; of public works; of finance and commerce; and of posts and telegraphs.

*Finances.*—The customs revenue fluctuates a good deal. Thus, in 1896 it was \$1,545,450; but \$2,392,052 in 1900; while the customs receipts for 1901 amounted only to 1,876,145 pesos, according to the report of the Belgian consul at San Domingo city; and again the United States minister to the republic shows that the receipts from the several ports during November 1902 were \$87,000, or less than one

half as much as in November 1901. The export tax on sugar was repealed 1 March 1902; otherwise duties are levied on both imports and exports. The public debt amounted to \$13,589,750 before 1898. In 1901 the foreign debt amounted to about \$21,000,000 and the internal debt to \$2,845,550 gold and \$10,126,629 silver. The San Domingo Improvement Company, of New York, was entrusted with the collection of the customs duties 1 March 1893.

*Army and Navy.*—A regiment of soldiers is usually stationed in each province, and these, with the reserve corps, constitute the army. The government has three small gunboats.

*Population.*—The number of inhabitants in 1888 was, on high Spanish authority, 417,000, but according to an official estimate 610,000. No recent enumeration is trustworthy. The Desplado region—the nearly uninhabited district of high mountains, inaccessible valleys, and virgin tropical forests—comprises, roughly speaking, the central third of the entire area of the island, or one half of the Dominican republic: it is the wide border-land fought over by the Haitians and the San Domingans. The latter, of blended Spanish, Indian, and negro blood—with the small proportion of white descendants of the Spanish colonists and foreign merchants—occupy a restricted area, and, it is thought, scarcely number 600,000. Spanish is the language most in use.

*Education, Religion, Judiciary.*—Free primary instruction is offered by the communes, with the aid of the central government; the system including also superior technical and normal schools, and a professional school or university. There are about 40 newspapers. The state religion is the Roman Catholic. Religious toleration under "certain restrictions" is assured by the government's present policy of encouraging immigration. There are, beside the supreme court, 11 district tribunals and the municipal courts.

*History.*—Columbus, on his first voyage to America visited the north coast of the island and left a few of his men. These were killed by the natives; but the colony of Isabela, established on his second voyage, endured until the colonists were transferred to a more healthful locality. His settlement on the south coast, near the present city of San Domingo, was made during his third voyage—that of 1498. Spanish settlements existed also at Concepcion de la Vega, Puerto Plata, Santiago de los Caballeros, and Bonao in the first decade of the 16th century. The cultivation of sugarcane began in 1506. Three years later Christopher and Bartholomew Columbus were imprisoned by Bobadilla in the citadel of San Domingo. The natives were set to work in the mines and fields; and very soon shiploads of Indians were being transported from other islands to replace those who died under the hardships of this forced labor. (see BAHAMAS). Negroes were brought from Africa for the same purpose, a considerable number of black slaves reaching the colony before 1522. There was a short period of prosperity; before the middle of the century, however, the most enterprising colonists were drawn away by the superior attractions of Mexico and Peru, and the country began to suffer from the attacks of English and French buccaneers, who established their headquarters on a small island near the northwest corner of

## DOMINICANS—DOMINIS

Haiti. In the course of a century and a half the section west of the Despoblado, and now known as the republic of Haiti, was won for France. The Spanish government at the close of the 18th century abandoned the eastern section as well, the entire island passing, first, under French control; but soon afterward the successes of Toussaint L'Ouverture and Dessalines (q.v.) united west and east in one country, independent of the European powers and governed by the black revolutionists of Haiti. Between 1809 and 1821 Spain again held the eastern section, and the old name Santo Domingo was revived with that limited application; but in the year last mentioned the San Domingoans revolted. Many of the Spanish families withdrew permanently from the island. San Domingo and Haiti were united from 1822 to 1843, together forming the republic of Haiti. The final separation took place in 1844, when the Dominican republic was established. Spain reasserted her authority once more for a brief period (1861-5); with that exception the many struggles through which the country has passed since 1844 have been due either to revolutions or to Haitian antipathy. In 1869 a treaty for the annexation of the Dominican republic to the United States was negotiated, during Gen. Grant's presidency, but was defeated in the United States Senate. A revolution which drove President Baez into exile expressed the resentment of the San Domingoans when this failure was made known. Comparatively good order was maintained for a few years, beginning in 1890, but the most violent methods were resumed by political leaders in 1898-9, and continued in 1902-3. President Jimenez was forced by a revolutionary uprising to resign his office in May 1902. His successor, Vasquez, was driven from power early in May 1903, after severe fighting, attended with heavy losses.

**Bibliography.**—Bulletins of the International Bureau of the American Republics; Chevalier, 'Lettres sur les maladies de St. Dominique,' etc.; Edwards, 'An Historical Survey of Saint Domingo'; Fabens, 'Life in San Domingo'; Guillermin, 'Journal historique de la révolution de la partie de l'Est de Saint-Dominique'; Harvey, 'Sketches of Hayti,' etc.; Hazard, 'Santo Domingo, Past and Present'; Hill, 'Cuba and Porto Rico, with the Other Islands of the West Indies'; Perkins, 'Reminiscences of the Insurrection of St. Domingo'; Sumner, 'Violations of International Law and Usurpations of War Powers': a speech delivered in Senate of United States 27 March 1871.

MARRION WILCOX.

**Dominicans, or Friars Preachers, or Preaching Friars** (*Fratres Prædicantes*), the religious order founded by St. Dominic. While laboring in Provence for the conversion of the Albigenses, Dominic associated to himself 16 disciples eager, like himself, to devote their lives to the work of reclaiming heretics and ministering to the spiritual needs of the poor and ignorant. In 1215 he visited Rome to obtain from the Holy See approval of the institute he proposed to form. Of the 16, 8 were French, 6 Spanish, 1 Portuguese, and 1 English. The Pope (Innocent III.), in conformity with the decree of the Lateran Council, then in session, against approval of new religious orders, refused again and again his consent, but at last

promised to give his approbation on the condition that the friars should adopt as their own the monastic rule of the Augustinians. The condition having been fulfilled, the order was formally approved in 1216 by Innocent's successor, Honorius III. The costume of the friars was to resemble that of the Augustinians, and to consist chiefly of a black cassock and rochet; but a few years afterward this was changed for the white habit and scapulary with outside black mantle, which is still the costume of the Dominicans. Their name Black Friars was given them because of the black mantle worn out of doors. The memory of their great monastery in London is preserved in the name Blackfriars Bridge. Houses of the new order were immediately founded in France, the Rhineland, and Italy; and in 1221 was held the first general chapter of the order at Bologna in which were represented 60 convents of preaching friars. That same year arrived in England the first band of Dominicans, 12 of the brothers in charge of Gilbert de Fremey. At this chapter an addition was made to the rule of the order, by which the Dominicans were forbidden to hold any possessions or have any fixed incomes; but to live by the voluntary alms of the people: thus the Friars Preachers became mendicant friars like the Franciscans. All the universities were opened to the young scholastics of the order, and soon many preaching friars attained the foremost rank as philosophers, divines, canonists and scholars. Among divines and philosophers the Dominicans Albert the Great and Thomas Aquinas hold the highest places; the celebrated German mystics and divines Meister Eckhart, John Tauler, and Henry Suso were Dominicans. The great mediæval encyclopædic work, *Speculum Majus*, was the work of a Dominican, Vincent of Beauvais. The highest places in the Church have been occupied by Dominicans; since the order was founded there have been 3 Dominicans popes, 60 cardinals, 150 archbishops, and more than 800 bishops. A second and a third order were also founded by St. Dominic, the second order being for women, and the third for men and women living in the world, engaged in secular pursuits and married. (See **TERTIARIES**). The Dominican houses suppressed in England by Henry VIII. numbered 58.

**Dominie Sampson**, the schoolmaster in Sir Walter Scott's 'Guy Mannering.'

**Dominion of Canada.** See **CANADA**.

**Dominique.** See **DOMINICA**.

**Dominis, Marco Antonio de**, mār'kō ān-tō'nē-ō dā dōm'ē-nēs, Italian theologian and ecclesiastic: b. Arbe, an island in the Adriatic, 1566; d. Rome 28 Sept. 1624. He studied in the college of the Jesuits at Loretto and in the University of Padua, and was made bishop of Segni 1596, and archbishop of Spalatro or Spalato 1602. Here he projected schemes for the reformation of the Church and unification of Christendom, but came into disfavor at the Roman court and had to quit, take refuge at Venice, where he made the acquaintance of Bedell, chaplain of the English embassy, afterward bishop of Kilmore in Ireland. De Dominis accompanied Bedell to England and through his influence obtained from King James the deanery of Windsor and other places in the Established Church. He was zealous for the overthrow of

the papal system and published in London (1670) a work in Latin, 'De Republica Ecclesiastica,' designed to prove that the Pope possesses in the Church only a primacy of honor not of jurisdiction. In 1619 was published his translation into English of Fra Paolo Sarpi's 'History of the Council of Trent.' He returned to Rome 1622, at the instance of the Spanish ambassador at London, who led him to believe that he would be welcome there and would be raised to the cardinalate. He published a recantation of his subscription to the Anglican articles of religion, but his hopes of honors at Rome were disappointed, and in letters to his friends in England he recanted his recantation: but the letters never reached their destination, having been seized by the papal officers. He was thrown into prison by order of Urban VIII. and there died 1624. After his death he was adjudged a heretic: his body was disinterred and burned, and the ashes thrown into the Tiber. In 1611 was published his tract, 'De radiis visus et lucis in vitris perspectivis et iride' ('Of the Rays of Vision and Light in Perspective Glasses and the Rainbow'), in which is probably for the first time proposed the true theory of the rainbow.

**Domin'ium** (Lat. *dominus*, a master), in Roman law, the right by which any one exercised control over property, and by which he was entitled to retain or alienate it at pleasure, as opposed to a mere life interest, or possessory or equitable right. *Dominium directum*, in feudal law, is the interest or superiority vested in the superior; and *dominium utile* is the interest in property vested in the vassal, which amounts to the right of merely using it (see *SERVITUDES*, *USUFRUCT*) as distinguished from that of his lord's ownership and supremacy.

**Domino.** See MASK.

**Domino Whist.** See FIVE OR NINE.

**Dominoes**, a game played with small flat rectangular pieces of ivory, about twice as long as they are broad. They are marked with spots varying in number. Each domino has two sets of spots ranging in number from 0 up to 12, which are distributed in all possible combinations—0-0, 0-1, 0-2, 0-3, etc., to 0-12; then 1-1, 1-2, 2-3, 2-4, and so on up to 12-12. Those which have the two sets of spots alike—2-2, 3-3, etc., are called double twos, double threes, etc. The game is to appearance remarkably simple, but is played in a variety of ways. The general principle of all the varieties is that when one player leads by laying down a domino, the next must follow by placing alongside of it another which has the same number of spots on one of its sides. Thus if the first player lays down 6-4, the second may reply with 4-8, or 6-7, etc.; in the former case he must turn in the 4, placing it beside the 4 of the first domino, so that the numbers remaining out will be 6-8; in the latter case he must turn in the 6 to the 6 in like manner, leaving 4-7, to which his opponent must now respond. The player who cannot follow suit loses his turn; and as the object of the game, modified by special conditions in the different varieties, is to get rid of all the dominoes in hand, or to hold fewer spots than your opponent when the game is exhausted by neither being able to play, it is a special point of play to shut out your opponent when it can be done without injury to your own hand.

**Dom'inus**, the Latin word which we commonly render by "lord," but which more properly signifies the master of a house, and his eldest son, as opposed to slave (*servus*). The Scottish "dominie," in the sense of schoolmaster, is of course taken from it, as is the same term in America, where in some places it is the title of a minister of the Dutch Reformed Church, and in others is applied to Protestant clergymen generally.

**Domitia**, dō-mīsh'ī-a, Roman empress: b. Gaul about 56 A.D.; d. Rome about 100 A.D. She was the daughter of Domitius Corbulo, a general of Nero's reign. She was married first to Ælius Lamia, but the Emperor Domitian took her for his wife. Finding that her new husband intended to have her executed she caused his assassination in 96 A.D. Her subsequent career is uncertain.

**Dom'i'tian**, Titus Flavius Domitianus Augustus, Roman emperor: b. Rome 24 Oct. 51 A.D.; d. there 18 Sept. 96 A.D. He was a son of Vespasian, and brother of Titus, and made himself odious, even in youth, by his indolence and voluptuousness, and his cruel, malignant, and suspicious temper. He became emperor 81 A.D. At first, indeed, he deceived the people by acts of kindness, good laws, and a show of justice, so that their fears vanished; but he soon returned to his former excesses and cruelty. Agricola's victories exciting his jealousy, he recalled that general to Rome, and kept him in total inactivity. At the same time he spread terror through Rome by the execution of a great number of the first citizens. He gave himself up to every excess, and to the meanest avarice. He at last conceived the mad idea of arrogating divine honors to himself, assumed the titles of Lord and God, and claimed to be a son of Minerva. His principal amusement consisted in the shows of the circus. The misery of the people was, meanwhile, continually increasing; and after the revival of the law against high treason, which enabled almost anything to be construed into this crime, no one was secure of his property or his life. A paper fell into the hands of his wife, Domitia, in which she found her own name, and those of the two commanders of the prætorian guards, with many others, noted down by the emperor as victims. This discovery induced her to conspire against him, and he was killed by a freedman named Stephanus.

**Domremy-la-Pucelle**, dōn-rā-mē-lā-pū-sēl (original, Domremy; La Pucelle, that is, The Maid, has been added in honor of Joan of Arc), a small village in the department of the Vosges, in France, not far from Vaucouleurs, in the department of the Meuse. It is noted for being the birthplace of Joan of Arc. The village contains a bronze statue of the heroine, and another monument to her, and the cottage in which she was born still stands. A chapel on a neighboring hill marks the spot where she is said to have learned of her great mission. There is here also a museum. Domremy was exempted from taxation till the Revolution, in honor of the warrior-maiden.

**Don** (Lat. *dominus*), a Spanish title of honor, originally given only to the highest nobility, afterward to all the nobles, and finally used indiscriminately as a title of courtesy. It corresponds with the Portuguese Dom. During the Spanish occupation it was introduced



and became naturalized in some parts of Italy, particularly in Naples.

**Don Carlos.** See CARLOS.

**Don César de Bazan,** *dōn sā-zār dū bā-zān*, the title of a French comedy founded on a portion of Hugo's play, 'Ruy Blas.' Don César is a ruined nobleman who changes his name, and in rags conducts himself with the happy, devil-may-care nonchalance of his better days.

**Don Gerard,** Dutch painter. See DOW, GERARD.

**Don Giovanni,** *dōn jō-vān'nē* (Italian form of Don Juan, the name of the hero), the title of an opera by Mozart, considered his masterpiece, produced at Prague 29 April 1787.

**Don Juan,** *dōn jū'an*, Sp. *dōn hoo-ān'*, the hero of a Spanish legend which seems to have had some historical basis in the history of a member of the noble family of Tenorio at Seville. According to the legend Don Juan was a libertine of the most reckless character. An attempt to seduce the daughter of the governor of Seville brought the indignant father and the profligate don into deadly conflict, in which the former was slain. Don Juan afterward, in a spirit of wild mockery, goes to the grave of the murdered man and invites the statue of him erected there to a revel. To the terror of Don Juan the "stony guest" actually appears at the table to bear him away to the infernal world. The tale has furnished the subject for many dramas and operas. The most famous of the latter is Mozart's 'Don Giovanni' (q.v.). Among the former are: 'Burlador de Sevilla' by Tellez; 'Don Juan ou Le Festin de Pierre,' by Molière; and 'The Libertine,' by Shadwell. The 'Don Juan' of Byron's poem bears no relation to the Don Juan of legend, save the name and libertine character of the hero.

**Don Orsino,** a novel by Francis Marion Crawford, published in 1892. The author's purpose is to describe a young man of the transition period in Rome after the unification of Italy. He chooses for his hero Orsino Saracinesca.

**Don Pasquale,** *dōn pās-kwā'lā*, an opera by Donizetti, produced 4 Jan. 1843 in Paris. It is considered one of the composer's best, although it never had a place in public estimation, such as was given to 'Lucie'; 'La Favorita'; 'La Figlia del Reggimento'; and others.

**Don Quixote,** *dōn kwiks'ōt*, Sp. *dōn kē-hō'tā*, a novel by Cervantes, in two parts, the first of which appeared at Madrid in 1605 and the second in 1615. The hero is a country gentleman who under the influence of the many romances he has read sets forth in search of adventures, accompanied by his squire, Sancho Panza (q.v.). From the hero's name is derived the word quixotic. For the author's aim in writing this book, see CERVANTES.

**Don,** or **Dun,** a river of Yorkshire, England, which rises near Cheshire, flows east and southeast and joins the Ouse after a course of about 55 miles. By artificial cuttings and canals it has been rendered navigable for vessels of 50 tons, to Sheffield, a distance of about 40 miles.

**Don** (ancient TANAI), a river of Russia, which issues from Lake Ivan-Ozero, in the government of Tula, and flows southeast and south-

west about 1,200 miles into the Sea of Azof, near the town of Azof, by three mouths, only one of which is navigable. The delta of the Don is an expanse of sandy flats, about 28 by 22 miles at the coast-line. Near its head is the important river-port of Rostov, and Taganrog also shares in the Don traffic. The Don has the most busy trade of all the rivers of south Russia. The navigation is generally stopped by ice for about three months of the year; nevertheless, by means of its lower course, in connection with the Volga, the south provinces of Russia receive much Siberian produce, and also manufactured goods from the interior of the empire.

**Don,** a river in the county of Aberdeen, Scotland. Its source is several small streams flowing from a bog about 1,900 feet above the sea. It flows east into the North Sea. It is about 75 miles in length. Its salmon fisheries are of considerable value.

**Do'na Francis'ca,** Brazil, a German colony in the state of Santa Catharina, lying between the Serra do Mar and the Atlantic Ocean, 14 miles inland from the port of São Francisco. Area. 97 square miles; pop. (1903) 21,000. Chief town, Joinville, with 2,700 inhabitants.

**Donald,** Elijah Winchester, American Episcopal clergyman: b. Andover, Mass., 31 July 1848. He was graduated from Amherst College, in 1869, entered the Episcopal ministry and has been rector of Trinity Church, Boston, from 1892. He has published 'The Expansion of Religion.'

**Donaldson,** Edward, American naval officer: b. Baltimore 17 Nov. 1816; d. 15 May 1889. He entered the navy in 1835; and in the Civil War took part in the attack on forts Jackson and St. Philip, in the passage of Vicksburg, and in the battle of Mobile Bay. He retired from active service in 1876.

**Donaldson,** James Lowry, American soldier: b. Baltimore 17 March 1814; d. there 4 Nov. 1885. He was graduated from West Point and entered the army in 1836. He fought in the Florida war, in the Mexican War, and in the Civil War. At the close of the latter he received the rank of major-general in the United States army. He wrote 'Sergeant Atkins' (1871), a story of the Florida war.

**Donaldson,** Thomas Leverton, English architect: b. London 19 Oct. 1795; d. there 1 Aug. 1885. He was professor of architecture at University College, London, 1841-65, and emeritus professor there for the rest of his career. He published 'Pompeii' (1827); 'A Collection of the Most Approved Examples of Doorways from Ancient Buildings in Greece and Italy' (1833), etc. Among buildings designed by him are University Hall, Gordon Square, London, and the Scottish Corporation Hall.

**Donaldson,** Washington H., American aeronaut: b. Philadelphia, Pa., 1840. In early life he was by turns a gymnast, a ventriloquist, a conjurer, and a tight-rope walker. A hotel proprietor presented him with a balloon, whereupon he became an aeronaut, and made himself famous all over the United States by his daring and reckless ascensions. On 15 July 1875, he made an ascension from the lake front in Chi-



cago and neither Donaldson nor his balloon was ever seen thereafter.

**Donaldsonville**, La., town, county-seat of Ascension Parish; on the Mississippi River, and the Texas & P. R.R.; about 30 miles in an air line south of Baton Rouge. It is the trade centre of a cotton, rice and sugar-growing county. Pop. (1900) 4,105.

**Donatello**, dōn-ă-tě'lō (properly, DONATO DI BETTO BARDI), a famous sculptor: b. Florence about 1386; d. Florence 1466. His family had several distinguished literati among its members, and repeatedly, from the middle of the 16th century, had given a doge to Venice. His first great works in marble were statues of St. Peter and St. Mark, in the Church of Or San Michele in his native city. His own favorite piece was the statue of an old man in senator's dress placed on the Campanile, and known by the name of Il Zuccone, or The Bald-Head. For the Church of St. John he executed a Penitent Magdalen in wood; but in this branch of art he was surpassed by his friend, Brunelleschi, with whom he made a journey to Rome to acquaint himself with its treasures. After his return to Florence he executed for his patrons, Cosmo and Lorenzo de Medici, a marble monument to their father and mother, which excited universal admiration. One of the principal ornaments of the Church of Or San Michele, is a marble statue of St. George, surpassed by no similar statue which has since been erected. This statue was ordered by the Guild of Armors (1416). Among his other leading works are a St. John the Baptist, in the Bragello; Judith and Holofernes, in the Loggia dei Lanzi; David, in the Museum, Florence; St. Cecilia, in profile, owned by Lord Elcho, in England. Notwithstanding his strictness he was honored as a father by all his scholars, among whom were Desiderio da Settignano, Benedetto di Majano, and Nanni d'Antonio. Consult: Radcliffe, 'Schools and Masters of Sculptors'; Perkins, 'Handbook of Italian Sculpture'; Clement, 'Sculpture'; and Vasari.

**Donati**, Giovanni Battista, jō-văn'nē băt-tēs'tā dō-nă'tē, Italian astronomer: b. Pisa 16 Dec. 1826; d. Florence, 19 Sept. 1873. He was appointed in 1852 assistant at the observatory in Florence, of which he became director in 1864. Here he discovered, *inter alia*, the brilliant comet of 1858, which is known as Donati's comet. He afterward was instrumental in erecting the fine observatory at Arcetri, near Florence, and constructed a spectroscope of 25 prisms.

**Donation Lands** are lands donated by Congress to actual settlers, out of the public domain. On 4 Aug. 1842, the lands in east Florida were thrown open to public settlement, by the grant of a quarter-section (160 acres) to every able-bodied adult. On 27 Sept. 1850, a similar act was passed for Oregon, granting from a quarter-section to a full section according to conditions. Later acts provided for rights of reversion on these. Donations of land for coast defenses, from private individuals to the government, are provided for by law.

**Don'tatists**, a heretical sect in the 3rd century, and till the Vandal invasion a formidable opponent of the Roman Catholic Church in the Mediterranean provinces of Africa. The sect arose out of dissensions at Carthage over

the question of the readmission to church fellowship of those persons who in Diocletian's persecution had denied the faith either explicitly or implicitly, by giving up to the persecutors the Christian sacred books. On that point they were extreme rigorists, as also in holding that a priest or deacon could not validly administer baptism if he were himself in a state of sin. When Mansurius was consecrated bishop of Carthage, the faction, headed by one Donatus repudiated him as a *traditor*, one who had given up the sacred books; and when after his death (311), Cæcilian became bishop of Carthage, 70 Numidian bishops refused to have communion with him, as one that was consecrated by a *traditor*. They set up a rival bishop, Majorinus, and the schism grew steadily wider, being specially favored by the peasants. The schismatics were condemned by Melchiades, the reigning Pope, with three bishops of Gaul, in 313. This judgment was confirmed the next year by the council of Arles, and in 316 by the council of Milan, convoked under the protection of the emperor Constantine; but the Donatists paid no heed, and in 330 a council was held by 270 Donatist bishops who denounced their opponents as heretics. The peace not only of the Church but of the civil state was seriously compromised by uprisings of the fanatical multitude against the Roman Catholics throughout northern Africa, to repress which the severe laws enacted by the emperors were ineffective. St. Augustine, bishop of Hippo from 400 to his death in 430, labored zealously to restore peace to the Church. In 411 he held a conference with 279 of their bishops at Carthage. The sect early began to split up into independent smaller sects, and they disappeared from the page of history after the Vandal invasion in 429.

**Donatus**, dō-nă'tūs, Ælius, Roman grammarian and commentator who lived in the 4th century. He wrote an elementary work on the Latin language, 'De octo partibus orationis,' which served as a guide to the learning of Latin in the Middle Ages, and formed the groundwork of most elementary treatises until recent times. It was one of the books most frequently printed at the commencement of the art, several editions having been issued from blocks even before the invention of types.

**Donau**, dō'now. See DANUBE.

**Donauwörth**, dō'now-vért, Germany, a walled town of Bavaria, at the junction of the Wörnitz and Danube, about 25 miles north by west of Augsburg. The monthly live stock market is a source of wealth to the town. Pop. 4,083.

**Don'caster**, England, a municipal borough in the West Riding of Yorkshire on the Don. It has long been famous for its annual races, begun in 1703. Nearby are the ruins of Conisborough Castle, the stronghold of Athelstan in Scott's 'Ivanhoe.' Pop. (1900) 25,000.

**Dondo**, dōn'dō, West Africa, a town of Angola situated at the head of navigation on the Coanza River, and not far from the Loanda Railway. It has a considerable caravan trade and is an import coffee market. Pop. 3,000.

**Dondrah** (dōn'dră) or **Dondera Head**, the southern extremity of the island of Ceylon, a steep and rugged promontory, formerly the site of a temple.

**Donegal**, dōn'e-gal, county in the province of Ulster, Ireland; area, 1,190,269. About one half is good farming land, but the mountainous districts are rich in minerals. Pearl-mussels abound in the rivers. Pop. 185,635.

**Don'elson, Andrew Jackson**, American diplomatist; b. near Nashville, Tenn., 25 Aug. 1800; d. Memphis, Tenn., 26 June 1871. He was graduated at the United States Military Academy in 1820, and entered the army as a lieutenant of engineers. In 1822 he resigned, studied law, and also engaged in cotton raising in his native State. He filled a number of responsible offices; was private secretary to President Jackson in 1829-30; minister plenipotentiary to Prussia, and later to Germany, in 1846-9; was editor of the *Washington Union* in 1851-2; was candidate of the American party for Vice-President in 1856; and after his defeat retired to private life.

**Donetz**, dō-nyets', or **Severnoi Donetz**, a river in Russia which, rising in the government of Kursk, flows almost due south about 400 miles into the Don.

**Don'gan, Thomas**, EARL OF LIMERICK, English colonial official: b. Castleton, Ireland, 1634; d. London, 14 Dec. 1715. After serving in the British and French armies he was appointed colonial governor of New York by the Duke of York in 1682. He gave the city of New York its first charter in 1686 and being accused of ignoring his pacific instructions regarding the French and Indians, and of inciting the Five Nations to war, resigned his commission in 1688, returned to England in 1691, succeeding to the earldom of Limerick in 1698.

**Dongola**, dōng'gō-lā, a province of Nubia, in Africa. The chief town of this district is of the same name. Pop. about 6,000.

**Dongola Kid**. See LEATHER.

**Don'iphan, Alexander William**, American military officer: b. Mason County, Ky., 9 July 1808; d. Richmond, Mo., 8 Aug. 1887. He began the practice of law in 1830 in Lexington, Mo. He was three times elected to the Missouri legislature. He served in the Mexican war, in which he made a brilliant record, capturing Chihuahua after an unexpected encounter with an army of 4,000 men. He was one of the peace commissioners at the convention which met at Washington previous to the Civil War.

**Donizetti, Gaetano**, gā-ā-tā'nō dō-nē-dzēt'-tē, Italian composer: b. Bergamo 25 Nov. 1797; d. there 8 April 1848. He studied music at Bologna under the distinguished Abbé Mattei. His first opera, 'Enrico di Borgogna,' was represented at Venice in 1818. In 1822 his 'Zoraide di Granata' gained him the honor of being crowned on the capitol. In 1830 appeared his 'Anna Bolena,' which first, with 'Lucrezia Borgia' and 'Lucia di Lammermoor,' the latter his masterpiece, acquired for him a European fame. In 1835 Donizetti was appointed professor of counterpoint at the Royal College of Naples, but removed in 1840 to Paris, bringing with him three new operas, 'Les Martyrs,' 'La Favorita,' and 'La Fille du Régiment,' of which the last two are among his most popular productions. Of his other operas none except 'Linda di Chamouni' (1842) and 'Don Pasquale' (1843) achieved any special triumph. See Ferris, 'Great Musical Composers' (1887).

**Donjon**, dūn'jūn or dōn'jōn (Lat. *dominus*, lord, changed to mean master or lord over), the grand or principal or commanding tower or keep of a mediæval castle, frequently raised on an artificial elevation. It was the strongest portion of the building, usually detached from the surrounding buildings. The donjon contained the great hall and principal rooms of state for solemn occasions, and also the prison fortress; from the last is derived the word dungeon.

**Donkey**. See ASS.

**Donkey Engine**, a small auxiliary steam-engine in a ship, not used for propelling but to assist in performing various operations where no great power is required. Thus a donkey engine is often stationed on the deck of a ship to work a crane for loading and unloading.

**Don'levy, Harriet Farley**, American editor and author: b. Claremont, N. H., 18 Feb. 1817. She was educated as a teacher, but abandoned this pursuit and worked in cotton-mills at Lowell. From 1840 to 1848 she edited a mill-girls' magazine, 'The Lowell Offering,' acting as contributor, editor and publisher of the 'New England Offering,' with which she was connected till 1850. She married John Intaglio Donlevy in 1854, who died 1872. Among her works are: 'Shells from the Strand of the Sea of Genius,' reprints from 'Lowell Offering' (1847); 'Happy Hours at Hazel Nook' (1852); 'Christmas Stories'; 'Mind Among the Spindles,' London (1849); also a reprint from the 'Lowell Offering.'

**Donne, dōn, John, D.D.**, English poet and divine; b. London 1573; d. there 31 March 1631. His parents were Roman Catholics, but in his 19th year he abjured that religion, and became secretary to the Lord-chancellor Egerton. He continued in that capacity five years, but finally lost his office by a clandestine marriage with his patron's niece. He subsequently took orders by the desire of King James, and was soon after made one of his chaplains. In 1621 he was appointed dean of St. Paul's. He was chosen prolocutor to the convocation in 1623-4; and, in consequence of a dangerous illness, soon after wrote a religious work, entitled 'Devotions upon Emergent Occasions.' As a poet, and the precursor of Cowley, Donne may be deemed the founder of what Dr. Johnson calls the metaphysical class of poets. Abounding in thought this school generally neglected versification, and that of Donne was peculiarly harsh and unmusical. He wrote Latin verse with much elegance. A collection of his Latin poems was published in 1633. Of his prose works, one of the most remarkable is that entitled, 'Biathanatos,' to prove that suicide is not necessarily sinful, which he never published himself, but which found its way to the press after his death. His style is quaint and pedantic; but he displays sound learning, deep thinking, and originality of manner. Besides the works already mentioned, he wrote the 'Pseudo-Martyr' (1610), letters, sermons, etc. See Gosse, 'Life and Letters of John Donne' (1899); Jessop, 'John Donne' (1897).

**Don'nelly, Eleanor Cecilia**, American author; b. Philadelphia, Pa., 6 Sept. 1838. She is a sister of Ignatius Donnelly (q.v.). Among her many volumes of verse are: 'Out of Sweet Solitude'; 'Domus Dei'; 'Legend of the Best

Beloved and Other Poems'; 'Crowned with Stars'; 'Hymn of the Sacred Heart'; 'Children of the Golden Sheaf and other Poems.' She has also written several prose works, including 'Life of Father Felix.'

**Donnelly, Ignatius**, American prose writer: b. Philadelphia, 3 Nov. 1831; d. Minneapolis, Minn., 2 Jan. 1901. He was prominent in Minnesota politics, but was best known as an author. Among his writings are: An 'Essay on the Sonnets of Shakespeare'; 'Atlantis, the Antediluvian World' (1882); and 'Ragnarök' (1883). In 'The Great Cryptogram' he endeavors to prove that Francis Bacon was the author of Shakespeare's plays. His best-known novel is 'Cæsar's Column.'

**Donner, Georg Raphael**, gā'örg rä'fä-äl dōn'nēr, Austrian sculptor: b. Essling, Austria, 25 May 1692; d. Vienna 15 Feb. 1741. He studied at the Vienna Academy of Architecture, and was employed at the imperial court, and also by Prince Esterhazy. Among his best works are the fountains on the Mehlmarkt, and at the city hall, Vienna, and a statue of Charles VI.

**Don'nybrook**, Ireland, a village now forming part of Pembroke township, in the county of and two miles southeast of Dublin. It is famous for its fairs, now abolished, which used to attract vast multitudes of persons, and seldom passed off without riot and bloodshed.

**Donoghue, John**, American sculptor: b. Chicago, Ill., 1857; d. New Haven, Conn., July 1903. He won a first prize over many competitors at the Chicago Fair for a classical group, 'Sophocles Leading the Chorus After the Battle of Salamis.' He designed the 'St. Paul' in the Congressional Library in Washington, the 'St. Louis of France' of the Appellate Division building in New York, and busts of Gov. Ames and John Boyle O'Reilly in the Boston Public Library. Other works were his 'Venus,' and 'Diana,' and best known of all, his 'Egyptian Ibis.'

**Don't Worry Circles**, associations formed in New York in the winter of 1897-8 from suggestions in 'Don't Worry: The Spiritual Law of Happiness,' published by Theodore F. Seward. The rules given for conquering the habit of worrying are based upon religious faith, common-sense and a spirit of helpfulness. For a time Washington was the centre of the movement.

**Do'nus**, Pope from 676 to 678. He is known as a patron of architecture, and adorned many of the churches of Rome; he also compelled the archbishop of Ravenna to recognize his authority. Sometimes a Donus II. is recorded as Pope for a short time in 974, but this is recognized as a mistake, due to an error of a copyist.

**Doo, George Thomas**, English line-engraver: b. Christ Church, Surrey, 6 Jan. 1800; d. Sutton, Surrey, 13 Nov. 1880. He made himself best known by his famous plates of 'Knox Preaching,' after Wilkie; of Eastlake's 'Italian Pilgrims Coming in Sight of Rome'; by his exquisitely finished heads of women and children, after Lawrence; and by his engravings from Raphael, Correggio, and others. His plate of the Calmady Children, titled 'Nature,' after Lawrence, produced in 1830, ranks as his master-

piece. In 1851 he was elected a Fellow of the Royal Society; in 1857 an academician. About 1853-5 he painted in oils, his works of this class being mainly portraits. In 1864 he completed, after eight years' work, a large engraving of the 'Raising of Lazarus,' by Sebastian del Piombo, his last important work.

**Dooley, Mr.** See DUNNE, FINLEY PETER.

**Doolittle, Charles Camp**, American soldier: b. Burlington, Vt., 16 March 1832. He entered the volunteer service during the Civil War, becoming colonel in 1862. He led a brigade at Nashville; and was commander of the northern district of Louisiana in 1865. In June, 1865, he was made major-general of volunteers, and was mustered out of service in November of the same year. He moved to Toledo, Ohio, where he was cashier of the Merchants' National Bank.

**Doom**, the old name for the "Last Judgment," a subject usually chosen for paintings over the chancel arch in parochial churches in England. Dooms were executed in distemper, and are of constant occurrence. In the reign of Edward VI. these representations were effaced, or washed over, as superstitious.

**Doom Palm**, or **Doum Palm**, a palm-tree, *Hyphane thebaica*, whose branches terminate in a tuft of large fan-shaped leaves. The fruit is about the size of an apple; it has a fibrous mealy rind, which tastes like gingerbread (whence the name gingerbread-tree sometimes applied to this palm), and is eaten by the poorer inhabitants of Upper Egypt, where it grows. An infusion of the rind is also used as a cooling drink in fevers. The seed is horny, and is made into small ornaments. Ropes are made of the fibres of the leaf-stalks.

**Doomsday** or **Domesday Book**, the record of a statistical survey of England, made by royal authority in the reign of William the Conqueror. The origin of the name has been much disputed. Popularly it has often been associated with the final day of judgment. There was a doom-book or dom-boc (q.v.) composed in the reign of King Alfred, which contained a collection of the laws and customs of the kingdom; and the doomsday book is conjectured to have taken its name from the fact of its containing the authoritative data on which legal decisions in regard to land and other collateral property were to be given. The general survey of the kingdom was ordered at Christmas 1085, and completed in the following year. It was made by commissioners appointed by the king, who collected the particulars at inquests from a sworn jury, consisting of sheriffs, lords of manors, presbyters, bailiffs, villains; all the classes, in short, interested in the matter. The information collected consisted in specifications of the extent of land in each district, their proprietors, tenure, and value; the state of culture, namely, the quantity of meadow, pasture, wood, and arable land; in some counties the number of tenants, villains, *cotarii* and *servi*; even the sheep and cattle on the different estates were taken, but these were not entered in the permanent record. Northumberland and Durham were omitted, and the northern part of Cumberland and of Westmoreland. The original 'Domesday Book' is preserved in the record office. It consists of

## DOON—DOPPLER'S PRINCIPLE

two volumes; one folio, one quarto. The republication of this valuable record was undertaken in 1767 and completed in 1783. Perfect facsimiles of the whole book in photozincography have also been made.

**Doon**, a river in Ayrshire, Scotland, which after a course of 30 miles flows into the Firth of Clyde. It is celebrated in the poems of Burns.

**Door**, a wooden or metal, sometimes stone frame or panel constructed to open and shut on hinges; used for entrances to buildings, rooms, etc. Sometimes made of one piece, but generally of several sections framed together. The doors of ancient Egypt and kindred countries swung upon vertical pintles which projected from the top and bottom of the door into sockets above and below. In China and other eastern countries doors may be seen to-day swinging on pivots. In modern carpentry, doors are classified under two general heads: batten-doors and panel-doors. The former are made of two or more boards placed longitudinally and held together by transverse rails. The latter are formed of a skeleton frame work into which is fitted lengths of thin board called panels. Folding and sliding doors have been improvements upon the hinge variety, working on tracks or grooves and having the particular value of economizing space.

**Door'ga**, in Hindu mythology the principal wife of Siva, one of the gods belonging to the Hindu triad. In Bengal the name Doorga is her appropriate appellation, and was given her by transference from the giant Doorga whom she slew. In southern and western India she is called Purwutee, or Parvati.

**Doorn**, a common name in South Africa. It indicates various communes in the Cape Colony. It also designates two rivers, in Africa, distinguished as Great and Little Doorn.

**Doorn'boom** (*Acacia horrida*), a tree common in South Africa. The name "thorn-tree," given to it by the Dutch colonists, and the botanical specific name, are due to the number and sharpness of its spines. It seldom much exceeds 30 feet in height, but its timber is hard and tough, and is much used for house-carpentry, etc. See ACACIA.

**Dope** (from Dutch *doop*, sauce) is a descriptive term meaning any thick liquid like molasses; a thick sauce or gruel or other viscous fluid or pasty thing used for eating is called a dope. Also a thick pasty lubricant like axle-grease. Fillers used in painting to fill the pores of the wood and prevent the absorption of the paint or varnish subsequently applied to the wood. A preparation of pitch, tallow and other ingredients which, when applied to the bottoms of shoes, will enable the wearer to lightly glide over softened snow. Any absorbent material, as cotton-waste for holding axle-grease or kieselguhr for holding nitro-glycerine. A stupefying substance like opium or chloral hydrate. For dynamite dopes see EXPLOSIVES.

**Dop'pler, Christian**, Austrian mathematician and physicist: b. Salzburg, Austria, 30 Nov. 1803; d. 17 March 1853. He was professor of mathematics at Prague 1841-7, and at Vienna held a similar post in the Polytechnikum 1848-51. For the last two years of his life he was director of the physical institute at Vienna

University. He published: 'Ueber das farbige Licht der Doppelsterne' (1842); 'Versuch einer systematischen Klassifikation der Farben' (1848); etc., and made known the noted "Doppler's Principle" (q.v.).

**Doppler's Principle**, a name given to the physical law (first enunciated in 1842 by Christian Doppler of Prague,) that the apparent wave-length of sound or light depends upon the velocities of the observer and of the source from which the radiation proceeds. For the sake of illustration, let the source of the radiation be stationary with respect to the medium that transmits the waves, and let the velocity of the waves in this medium be  $V$ . If  $N$  is the number of waves of a certain definite wave-length that the source emits every second, then the observer will also receive  $N$  of these waves every second, provided he remains stationary. If the observer is moving, however, the case is different. For example, suppose that he is receding from the source of the radiation with a uniform velocity  $v$ , and consider what happens in the course of a single second. During this second  $N$  waves reach his initial position, just as before; but at the end of the second he is  $v$  units of distance beyond that initial position, and hence it is impossible that all of these  $N$  waves can have reached him. The deficit will evidently be equal to the number of waves whose combined lengths would just measure  $v$ . But the source sends out  $N$  waves every second, and when the last of these  $N$  is just leaving the source, the first one of the series has proceeded to a distance  $V$ . Hence we know that the length

of one wave is  $\frac{V}{N}$ ; and to find the number of

waves that would be required to fill the distance  $v$ , we have only to divide  $v$  by the length of a single wave; that is, we have to divide it

by  $\frac{V}{N}$ . Hence the observer's motion will di-

minish the number of waves that reach him every second by  $\frac{Nv}{V}$ , and, therefore, when he

is receding from the source with the velocity  $v$ , he will receive only  $N - \frac{Nv}{V}$ , or  $\frac{N(V-v)}{V}$ ,

waves per second. The result will be, that the wave-length of the sound (or light) will appear to him to be longer than it really is. The same line of reasoning will show that if the observer is stationary and the source is receding with a velocity  $v$ , the number of waves that the observer will receive per second will

be  $\frac{NV}{V+v}$ . If the motion is such as to di-

minish the distance instead of increasing it, the algebraic sign of  $v$  must be reversed in the foregoing formulæ. The most familiar example of Doppler's principle is afforded by the sudden change in the apparent pitch of a sounding bell or whistle on an express train moving at high speed. If the observer stands close to the track, the pitch falls suddenly and very markedly, as the locomotive passes him. The most important applications of the principle, however, are in astronomy, in connection with the mea-

surement of the velocities of the celestial bodies, by observing the displacement that their motion produces in the positions of the lines of their spectra. (See SPECTROSCOPE.) If the earth is approaching a heavenly body, the lines in the spectrum of that body are all shifted slightly toward the violet end, owing to the apparent shortening of each wave-length by the motion. If the earth and the heavenly body are receding from each other, there is a similar displacement of the lines toward the red end. The rotation of Saturn's rings has been experimentally demonstrated in this way, and the velocities of approach and recession of many of the brighter fixed stars have also been determined. Certain stars have been demonstrated to be double, by the discovery that the lines of their spectra are periodically double and single; the lines appearing single when the relative motion of the two components is perpendicular to the line of sight, and double when the positions of the component stars are such that one star is approaching the earth while the other is receding from it. The orbits of certain of these stars have been determined by such measurements, even when the components of the systems are so close together that no telescope can show them separately, nor make them appear otherwise than as a single point of light.

**Dop'plerite** (named after B. Doppler, the first to bring it to notice), an amorphous mineral occurring in elastic or partly jelly-like masses found in peat-beds in Styria and Switzerland, and regarded as a fossil peat. When fresh it is a brownish-black, with a dull brown streak and greasy subvitreous lustre, insoluble in alcohol or ether. Dopplerite is also the name of a related mineral, grayish, earthy, and plastic in the fingers when fresh.

**Dor, or Bongo** (q.v.), the names given to a mixed tribe of negroes living in Central Africa, in the lowlands of the Bahr-el-Ghazal, eastern Sudan. The race is of medium size, attaining splendid muscular development. Their skin is red-brown. They are noted for remarkable productions in iron and wood work.

**Dor, or Dorr**, a species of beetle, belonging to the family of earth-borers. It is of a glossy violet, black, or deep greenish-black. The club of the antennæ is yellowish, the elytra smooth, but slightly punctated, as is the thorax. It may often be seen flying about in the summer evenings. Its size and weight render it very unwieldy on the wing, so that it has but little power of guiding itself, and apparently none of checking its course quickly, for it strikes against all kinds of objects, but without suffering any damage. The female lays its eggs in patches of cow-dung. It is about an inch long. It is also called dor- or dorr-beetle, dor-fly, and buzzard-fly.

**Dor, or Mont Dore**, *môn' dōr* (often written *Mont d'Or*), a chain of mountains in France belonging to the group of the Auvergne Mountains, in the department of Puy-de-Dôme. They are of volcanic formation. The Puy-de-Sancy, the highest peak of central France, is 6,190 feet.

**Dora d'Istria**, *dō'rā dēs'trē-ā*, pseudonym of ELENA GHICA, Rumanian author: b. Bucharest 22 Jan. 1829; d. Florence, Italy, 20 Nov. 1888. She married the Russian Prince Kolzow-

Massalsky. Her first work, 'Monastic Life in the Eastern Church,' alleges monasticism to be the principal obstacle to civilization in eastern and southern Europe. Her other works include: 'German Switzerland'; 'Women in the East'; 'Women, by a Woman.' She contributed many literary and historical essays to German, Italian, French, and Greek periodicals. Her studies on Albanian poetry gave rise to a nationalistic and literary movement among the Albanians. The Greek Chamber of Deputies, in April 1868, named her "high citizeness of Greece."

**Doran, John**, English essayist and critic: b. London 1807; d. there 28 Jan. 1878. He wrote: 'The Wandering Jew,' when he was 17, and the Surrey theatre staged it. His maturer performances, 'Table Traits and Something on Them' (1854); 'New Pictures and Old Panels' (1859); and a 'History of Court Fools' (1858), have merit.

**Dorat, Claude Joseph**, *klōd zhō'zēf dō-rā*, French poet: b. Paris 31 Dec. 1734; d. there 29 April 1780. He renounced the study of law, and afterward the military service, into which he had entered as a musketeer, and devoted himself entirely to poetry. He wrote numerous dramas which were unsuccessful. He has succeeded better in songs, tales, and poetical epistles, but though he had great facility in composition, his works are not much esteemed. Dorat's works appeared in Paris complete in 20 volumes (1786).

**Dorcas Gazelle**, the best known of the genus of gazelles, very common in northern Africa, Asia Minor, Arabia, and Syria. It attains a height of two feet; has tapering ringed horns from 9 to 10 inches long; and is of a tawny color with white under parts. It is noted for its speed, is naturally very wild, but easily becomes domesticated, and owing to its beauty and gracefulness is frequently alluded to in Oriental poetry. Its name is derived from the Greek *δορκάς*, through *δέρκεσθαι*, to look, owing to the size and brightness of its eyes.

**Dorcas Society**, the name given to an association of ladies who make or provide clothes for needy families, distributing the garments free or at a nominal cost. The name is taken from Acts ix. 39: "And all the widows stood by him weeping, and showing the coats and garments which Dorcas made, while she was with them."

**Dor'chester, Daniel**, American Methodist clergyman: b. Duxbury, Mass., 11 March 1727. He was educated at Wesleyan University and entered the Methodist ministry in which he has been prominent as pastor and presiding elder. He has been at various times a member of the Connecticut Senate and the Massachusetts House of Representatives, and has published: 'Concessions of Liberalists to Orthodoxy' (1878); 'Problem of Religious Progress' (1881); 'Latest Drink Sophistries versus Total Abstinence' (1883); 'The Liquor Problem in All Ages' (1884); 'The Why of Methodism' (1887); 'Christianity in the United States' (1888).

**Dorchester** (ancient Roman DURNOVARIA or DURINUM), England, a municipal borough, the county town of Dorsetshire. In March, 1645, Cromwell held the town as his headquarters



## DORCHESTER — DORIA

with 4,000 men, and in 1685 Judge Jeffreys held his "bloody assize" here, when 292 received sentence of death as being implicated in Monmouth's Rebellion. A Roman amphitheatre, in a good state of preservation, is near the town.

**Dorchester**, Mass., since 1870 one of the wards of the city of Boston. Dorchester, originally called Mattapan, was settled in 1630 by the Puritans, but the name was soon changed to Dorchester in memory of the English home of some of the settlers. It was by fortifying Dorchester Heights in March 1776 that Washington forced the evacuation of Boston by the British army. The place is noted as the birth-place of Edward Everett. The population is counted as a part of that of Boston.

**Dorchester**, New Brunswick, town, county-seat of Westmoreland County; at the junction where two small rivers enter Shepody Bay; and on the Intercolonial R.R. The industries are principally ship-building and nearby quarrying. Pop. (1902) 7,105.

**Dorchester Heights**, now South Boston, Mass. This hill on the peninsula, southeast of Boston proper, across a navigable channel, commands the city; and in the Revolution, when Boston was held by Howe in the winter of 1775-6, it was obviously of the first importance to fortify it. Howe neglected to do so, and on the evening of 4 March 1776, under Washington's orders, Gen. John Thomas, with some 2,500 men and the proper implements, took possession of the heights, and by the next morning a sufficient entrenchment had been thrown up. Howe promptly agreed to evacuate Boston if unmolested, and did so on the 17th, leaving all his guns and supplies unharmed for the Americans.

**Dordogne**, dōr-dōn-yē, a department of France which includes the greater part of the ancient province of Périgord, and small portions of Limousin, Angoumois, and Saintonge. It lies between Haute-Vienne on the north, Carreze and Lot on the east, Lot-et-Garonne on the south, and Charente, Charente-Inférieure, and Gironde on the west. Area, 3,550 square miles, of which about a third is fit for the plow. The chief minerals are iron, which is abundant, slate, limestone, marble, and other stone. Mining, iron manufacture, etc., are carried on to a considerable extent, and there are a number of vineyards. Also noted for its production of wines and truffles. The climate is mild, but somewhat changeable. Pop. (1901) 452,951. The river Dordogne, principal river of the department, rises on the flanks of the Puy-de-Sancy, flows west-southwest, and after a course of 290 miles unites with the Garonne in forming the Gironde.

**Dordogne**, a river of France, rising near Mt. Dore and flowing west for 305 miles, uniting with the Garonne about 15 miles north of Bordeaux. The river is navigable for steamers for nearly 190 miles.

**Dordrecht**, dōr-drēnt. See DORR.

**Doré**, Paul Gustave, pōl gūs-tāv dō-rā, French artist: b. Strasburg 6 Jan. 1833; d. Paris 23 Jan. 1883. In 1845 he was sent to the Lycée Charlemagne at Paris, and three years later his early developed skill as a designer and draughtsman of humorous and satirical subjects gained him a place among the illustrators of the

'Journal pour Rire.' From 1848 to 1853 he contributed to the Salon a series of pen drawings, such as 'Les Pins Sauvages'; 'Le Lendemain des Orages'; 'La Prairie'; etc., which attracted much attention. In 1857 he had honorable mention for landscapes and a picture of the battle of Inkerman. His productivity was extraordinary, and embraced almost all classes of subjects. He is best known in England as the illustrator of the Bible, 'Don Quixote,' and of the works of Dante, Milton, and Tennyson ('Idylls of the Kings'). He also illustrated Rabelais and works by Chateaubriand, Balzac, and other writers. As a painter he was less successful than as an illustrator of books. His works of this class were mostly immense canvases, among them being 'Paolo and Francesca da Rimini' (1863); 'The Neophyte' (1868), and 'Christ's Entry into Jerusalem' (1876).

**Doremus**, Robert Ogden, American chemist: b. New York 11 Jan. 1824. He was graduated at New York University in 1842, and from its medical department in 1850, having established his chemical laboratory in New York in 1848. He has filled the chair of chemistry at Bellevue Hospital Medical College and at the College of the City of New York. He patented noted chemical processes and fire extinguishers and has been a noted expert in toxicology.

**Doremus**, Sarah Platt Haines, American philanthropist: b. New York 3 Aug. 1802; d. there 29 Jan. 1877. She was married to Thomas C. Doremus in 1821. With several others she organized the Greek Relief Society in 1828, and with Catharine Sedgwick established in 1842 a Home for Women from Prison, since known as the Isaac T. Hopper Home. She assisted in founding the House and School of Industry and was officially connected with various benevolent institutions, besides working for a half century in behalf of foreign missions. During the Civil War she labored for sick and wounded soldiers, both North and South.

**Doria**, dō-rē-ā, one of the most powerful families of Genoa. It became distinguished about the beginning of the 12th century, and shared with the families Fieschi, Grimaldi, and Spinola the early government of the republic. These four were known as *Magnæ quatuor prosapie*, the four great families of this republic. The Dorias and the Spinolas belonged to the Ghibelline, the Fieschi and the Grimaldi to the Guelph faction; but as this division does not exhaust the combinations of which the number four is capable, the two distinct sections entertained their own private jealousies and quarreled among themselves, Guelph with Guelph and Ghibelline with Ghibelline, making, as it were, a bear-garden of the dark and deep streets of their formidable city.

**Doria**, Andrea, ān drā-ā, Genoese admiral: b. Oneglia 30 Nov. 1468; d. Genoa 15 Nov. 1560. He entered the Pope's guards and afterward passed into the service of the Duke of Calabria, who commanded in Italy for the king of Aragon. He was rapidly promoted, and Alphonso II. gave him a command against Ludovico Sforza, Duke of Milan. When the French had left Italy the Genoese entrusted the reconstruction of their fleet to Doria. He was first employed in suppressing the African pirates, from



## DORIAN MODE — DORION

whom he captured a large booty, but was soon after exiled, and entered the service of Francis I., who named him admiral of the French galleys. Displeased with some demands of the French king, who in answer to his complaints deposed him from his command, he entered the service of Charles V. in 1528. His defection proved disastrous to the French cause in Italy. He occupied Genoa without resistance on 12 Sept. 1528, and his further successes contributed to the re-establishment of peace. He re-established order in Genoa, and organized the government on a new basis, which became permanent during the independence of the republic. Charles bestowed on him the highest honors, and received in exchange the most important services. In 1532 he took Koron and Patras, in Greece, from the Turks, and in 1535 assisted in the capture of Tunis. He assisted next year in a descent on Provence, took Toulon, and ravaged the coasts of the Gulf of Lyons. The emperor and the king of France had afterward an interview, which has become historical, on board his galley, with a view to the conclusion of peace. This interview took place at Aigues-Mortes in July 1538. In 1547 he narrowly escaped assassination in a conspiracy raised in Genoa by the Fieschi. His nephew was killed in this conspiracy, which excited him to some severities approaching to the barbarity of earlier times. Doria has been accused, probably with justice, of selling his sword too freely, and to too many opposing interests; but his services to his country have earned him the titles of *father* and *liberator*, which were conferred on him, together with the censorship for life, by the Genoese senate in 1528.

**Do'rian Mode**, the standard Greek and ecclesiastical mode, the first of the authentic church tones or modes, from D to D, with its dominant note of A. It resembles the key of D minor, but with the B natural and no C sharp. It is characterized by its severe and austere progressions, and is especially adapted to religious or warlike music. Many of the old German chorals are written in this mode.

**Dorians**, one of the four great branches of the Greek nation. They derive their name, according to legend, from Dorus, the son of Hellen. They dwelt first in Histiazotis, were then driven by the Perrhæbi into Macedonia, forced their way into Crete, where the lawgiver Minos sprang from them, built the four Dorian towns (Dorica Tetrapolis) at the foot of Mount Eta, between Thessaly, Ætolia, Locris, and Phocis, and subsequently, together with the Heraclidæ, made a settlement in the Peloponnesus, where they ruled in Sparta. Colonies emigrated from them to Italy, Sicily, and Asia Minor. The Dorians were in many ways the reverse of the Ionians. The Doric manner always retained the antique style, and with it something solid and grave, but at the same time hard and rough. The Doric dialect was broad and rough; the Ionic, delicate and smooth; it was the form made use of in solemn odes, for example, in hymns and in choruses forming part of the national celebrations, and the acting of the drama at Athens. The Cretan and Spartan legislative codes of Minos and Lycurgus were much more rigid than the mild Athenian institutions of Solon. The Spartan women wore the light tucked-up hunting-dress,

while the Ionian females arrayed themselves in long sweeping garments. Both have been idealized by artists: the one in Artemis and her nymphs, the other in Pallas Athene and the Canephora. The same contrast appears no less strikingly in their architecture, in the strong, unadorned Doric, and the slender, elegant Ionian columns. See Müller, 'Die Dorier'; Grote, 'History of Greece.'

**Doric Order**, in architecture, the second of the five orders, being that between the Tuscan and Ionic.

*Grecian Doric.*—The Doric column was first adapted to edifices having the proportions, strength, and beauty of the body of a man. The trunks of trees probably suggested the first idea of columns, but in the Doric style the proportions of a man appear to have been adopted. A man was found to be six times the length of his foot, hence the plain Doric columns were made six diameters in height. From the middle of the 7th century to the end of the 6th century B.C., the Doric appears to have been the only style of architecture used by the Greeks, and its highest example is the Parthenon of Athens.

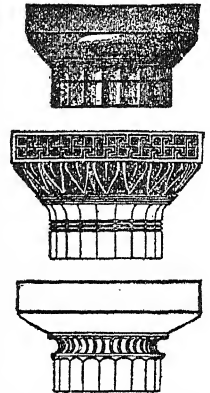
*Roman Doric.*—An imitation of the Grecian, with a true Greek entablature and a molded base. The column is slenderer than that found in the best Greek examples, and is possibly of Etruscan proportions.

**Dorigny, Louis**, 100-ē dō-rên-yê, French engraver: b. 1654; d. Verona, Italy, 1742. He with a son of Michael Dorigny (q.v.). He entered the school of Lebrun, and made a journey to Italy, where he copied the great masters.

**Dorigny, Michel**, mē-shel, French painter and engraver: b. St. Quentin 1617; d. Paris 1665. He was a scholar of Simon Vouet, whose works he etched, and whose faults in drawing he copied. His style of execution is bold, and his management of light and shade good. He became professor in the Academy at Paris.

**Dorigny, Sir Nicholas**, French engraver: b. Paris 1658; d. 1746. He was a son of Michael Dorigny (q.v.). He spent 28 years in Italy in studying the most illustrious masters, and 8 in engraving the famous cartoons of Raphael, at Hampton Court, for which he received the honor of knighthood from King George I. In 1725 he became a member of the Academy at Paris. One of his best engravings, besides his cartoons is the 'Transfiguration,' from Raphael, and the 'Apotheosis of St. Petronilla,' after Guercino. His engraving is easy and strong, and the work of the needle and the graver happily united.

**Do'ron, Sir Antoine Aimé**, Canadian jurist: b. St. Anne de la Perade, P. Q., 17 Jan. 1818; d. 3 May 1891. He was called to the bar in 1842 and became chief justice of the Province of Quebec in 1874. He held various cabinet positions and was knighted in 1877. During his



Grecian Doric Capitals. 1, plain; 2, jointed; 3, at temple of Ceres in Paestrum.

political career he was the leader of the French-Canadian Liberal party of the Province of Quebec.

**Dô'ris**, a small mountainous district of ancient Hellas, was the home of the Dorians (q.v.). It is now a part of the modern government of Phocis. Doris was also the name of a district in Asia Minor on the coast of Caria, inhabited by colonists from the Peloponnesus.

**Doris**, in mythology. See NEREUS.

**Doris**, in natural history. See SEA-LEMON.

**Dor'king**, England, town in Surrey, 22 miles southwest of London, noted for its breed of fowls. It is the scene of the fictitious 'Battle of Dorking.'

**Dorking**, a fowl. See POULTRY.

**Dormant Partner**, a commercial term, almost obsolete to-day, having given way to the more familiar expression silent partner (q.v.).

**Dormant State**. See HIBERNATION.

**Dormer Window** (Old French *dormeor*, a sleeping-room), a vertical window usually flush with the wall of the house and standing in a projection built out to receive it from a sloping roof. In ordinary house-building serves as an ornament and at the same time lighting and enlarging an attic chamber. Very picturesquely used throughout France, Belgium and the Netherlands. In Gothic and Renaissance architecture the dormer window effect was often employed on beautiful stone edifices.

**Dormitory** (Fr. *dormitoire*, from Lat. *dormire*, "to sleep"), formerly in a monastery or nunnery sleeping quarters either divided into cells or cubicles, opening upon a corridor, or one great apartment divided by partitions or curtains. In connection with American colleges and similar institutions the dormitory is often an entire building divided into bed-rooms.

**Dormouse**, the common name given to the family *Myoxida*, natives of the Old World. They are pretty little creatures, with soft, fine fur, and long, squirrel-like tails; but, unlike the squirrels, which they somewhat resemble in habits, they have no cheek-pouches. There are in all four genera of the *Myoxida*, containing about a dozen species, the best known of which is the red dormouse, "hazel mouse," or "muscardine" (*Muscardinus avellanarius*), which lives in the woods in most parts of Europe. It is about the size of the common house mouse; has a rather large head, a pointed muzzle, large, prominent eyes, and a hairy tail. It is reddish in color above, and white below. Its food consists of acorns, nuts (especially hazel nuts), and grain; which it stores for winter use, much as squirrels do. In the coldest weeks of winter it curls up and sleeps, waking, however, at intervals, in milder days, to feed upon its gathered stores. Its nest is usually made of tangles of herbage, with an opening at the top, and hidden in the underbrush. The fat dormouse (*Myoxis glis*) is larger than the red dormouse, and duller in coloring. It inhabits the forests of southern Europe, where it may be found leaping with remarkable agility from tree to tree. The garden dormouse (*Eliomys nitela*) lives nearer to man, being found in gardens, and often in barns. It destroys fruit grown along walls and trellises. The French call it "lerot"; the Germans "Gartenschläfer."

**Dorner, dô'r'nér, Isaak August**, German Protestant theologian: b. near Tuttlingen, Württemberg, 20 June 1809; d. Berlin, 8 July 1884. He studied theology and philosophy at Tübingen; and had already filled chairs at Tübingen, Kiel, Königsberg, Bonn, and Göttingen, when in 1861 he was called to be professor at Berlin. His greatest work is the 'History of the Development of the Doctrine of the Person of Christ' (1861-63). Among his other works are 'History of Protestant Theology' (1871); 'System of Christian Doctrine' (1880-4); 'Christian Ethics' (1887).

**Dor'nick**, a species of coarse, figured linen, named from Tournai or Doornick in Flanders. The manufacture introduced into England by the Dutch who fled from the persecutions of Alva was long confined by law to inhabitants of Norwich and Pulham. A similar cloth called dornock was made at Dornock, Scotland.

**Dornoch (dôr'nök) Firth**, an arm of the sea, on the east coast of Scotland. The town of Dornoch is near the entrance. Fishing is valuable, but navigation is difficult.

**Dornock**. See DORNICK.

**Dorohoi, dô-rô-hoi'**, Rumania, a town in the northwest of Moldavia, near the Austrian frontier. Pop. 15,000, half being Jews.

**Dorpat, dôr'pät, or Dörpt** (Lettish, *Tehrpat*), Russia, city in the government of Livonia, on the Embach, about 135 miles northeast of Riga. Dorpat is chiefly remarkable for its university, which was founded in 1632 by Gustavus Adolphus, when the Swedes were masters; it was suppressed, in 1656, by the Muscovites; and re-established by the Emperor Alexander, in 1802-3. To this institution is attached an observatory, which the labors of Dr. Struve have made famous, and a library with about 300,000 volumes. Pop. 45,000.

**Dorr, Julia Caroline (RIPLEY)**, American poet and prose writer: b. Charleston, S. C., 13 Feb. 1825. She removed to Vermont in 1830 where she married in 1847 S. M. Dorr, who died in 1884. Among her volumes of verse are: 'Poems' (1871); 'Friar Anselm' (1879); 'Daybreak, an Easter Poem' (1882); 'Afternoon Songs' (1885). Her prose works include: 'Lanmere' (1856); 'Sibyl Huntington' (1860); 'Expiation' (1872); 'Farmingdale' (1854); 'Bermuda,' a volume of travel (1884); 'Bride and Bridegroom, or Letters to a Young Married Couple'; 'The Flower of England's Face' (1895); 'A Cathedral Pilgrimage' (1896); 'Afterglow' (1900); 'In Kings' Houses' (1898).

**Dorr, Thomas Wilson**, American politician: b. Providence, R. I., 5 Nov. 1805; d. there 27 Dec. 1854. He was a member of the Assembly of Rhode Island in 1833-37, and was the leader of Dorr's Rebellion (q.v.). This was brought about by dissatisfaction with the constitution of the State; and a call for a constitutional convention was made by a party called the Suffrage Party, of which Dorr was the head. A new constitution was made by this convention and submitted to the people in 1841, receiving a majority of the votes. Dorr was convicted of high treason and sentenced to imprisonment for life, but was released under a general amnesty act in 1847, and restored to his civil rights in 1852.

## DORR REBELLION — D'ORSAY

**Dorr Rebellion, 1840-2.** Rhode Island after the Revolution continued under her charter of 1663 for nearly three quarters of a century (see CONSTITUTIONS, STATE), it being already that of a self-governing democracy. But it had two features growingly undemocratic, one of them sure to end in an explosion; the town representation in the legislature was based on 17th-century ratios of importance, since then greatly changed — thus, Newport with some 8,000 people had six members, Providence with 23,000 had four, Smithfield with 9,500 had two; and the suffrage constituted a propertied minority with primogeniture, being restricted to holders of \$134 worth of real estate or \$7 annual renters, and their eldest sons. Of 22,000 to 23,000 taxable polls, only 9,590 were freemen; Providence with above 23,000 inhabitants had 1,610 voters, Woonsocket with some 3,000 had 150, etc. Over \$1,000,000 of personal property in Providence was unrepresented. That city was naturally the focus of discontent; Newport as naturally the champion of the established order.

From 1834 on, when he was first chosen to the legislature, the discontent was voiced by Thomas Wilson Dorr, b. 5 Nov. 1805, a lawyer of a wealthy Whig family, and a Harvard graduate. He formed something like a suffrage party organization; but it dissolved from discouragement in 1838. A convention representing only the landholders meantime threw out with only seven votes a proposition to extend the suffrage, and the Whigs smothered the agitation till after Harrison's election in the fall of 1840. Then Dorr, who had joined the Democrats, organized mass-meetings, and the suffrage became the burning question of the hour during the winter. As the legal organs of relief were packed against them by the very system against which they protested, the disfranchised had no recourse but revolution. On the claim of "natural right," they held a convention in October 1841, drafted a constitution, and called for a popular vote upon it; only their own party voted, but by fictitious lists a vote of some 14,000 was computed, about twice the actual number cast. This being a majority of the legal voters, the suffrage party proclaimed the "People's Constitution" as the lawful régime of the State, 13 Jan. 1842. Meantime the landholders' party had called a legal convention, which met in November, split into angry factions, and adjourned to 14 Feb. 1842. But the proclamation of the revolutionary constitution sobered them down; they drew up one practically as liberal as the other, and for the first time allowed those qualified under it to vote on it. The suffrage party was now offered all it claimed; but it was too much committed to its new principle of mass-rule to recede, and the "Landholders' Constitution" was voted down, 8,689 to 8,013. On 13 April the suffragists held an election under the People's Constitution, at which only their own party voted, and chose Dorr governor, with a legislature and corps of State officers. Of course all these proceedings were legally null, and the "Law and Order Party," as they called themselves, recognized them only as treasonable attempts to overturn the legal government.

At an extra session in March the legislature had made the taking of office under the Dorr government treason, and acting as moderator or clerk at their elections a serious misdemeanor; a law dubbed by the Dorr party the "Algerine

Act." At the regular April elections Samuel W. King was chosen governor; and another extra session empowered him to proclaim martial law, and call on the federal government for the help against domestic insurrection guaranteed by the Constitution. President Tyler replied that help should be furnished when violence had actually supervened, but the government could not interfere on a mere apprehension. On 3 May Dorr and his party marched into Providence, and after debating a forcible occupation of the state-house, began legislative sessions in a disused iron foundry. They sat two days, formally repealed the "Algerine Act," demanded of Gov. King the custody of the State property, notified the federal government of their formation of the legitimate State government, etc., and adjourned to 5 July, but never met again. The regular legislature met at Newport 4 May, and the governor again appealed to the President, receiving the same answer; but the military commanders of the vicinity were ordered to keep in touch with the State authorities. Dorr went to New York and elsewhere for recruits and funds, came back on the 16th, and on the night of the 17th-18th undertook to capture the Providence arsenal, but his own men disabled his cannon and his force melted away — his chief adherents by this time being sick of the farce, when the other party were ready to grant all their demands. Dorr escaped into Connecticut (where the governor refused to give him up on requisition), and prowled around the border for several weeks, getting men and stores together — the former mainly young fellows on a "lark"; finally late in June he crossed the border, and the President decided that the time had come to order United States troops to interfere. On the 26th a crushing force marched against Dorr at Chepachet, R. I., and his men on that and the next day dispersed without waiting the event. Dorr remained in hiding for some weeks, and a reward was offered for him; in October he returned and gave himself up for trial, was convicted of high treason in March 1844, and sentenced to life imprisonment. He was pardoned in 1847, and restored to civil life in 1852. He died 27 Dec. 1854. Meantime, in November 1842, a new convention had been held by the regular authorities, adopted by the people 21-3 Nov. 1842, and became operative in May 1843. The suffrage was practically made universal. The proceedings of the state government were held legal by the United States Supreme Court in *Luther v. Borden*, argued by Webster (see his *Speeches*), and decided by Taney. It must be said for Dorr that but for the menace of civil war the suffrage never would have been extended; after the offer of the "Landholders' Constitution," however, he and his party became inexcusable disturbers of public order, risking bloodshed for the question of the legal theory under which the rights already obtained should be held. The great repository of material on this subject is the House Report of the 28th Congress, 1st session, No. 546; the best single summary is Francis Bowen's in the "North American Review" (1844).

**Dorrit, Amy**, the "Little Dorrit" of the novel of the same name, by Charles Dickens.

**D'Orsay, Alfred Guillaume Gabriel**, âl'frâ gē-yōm gāb-rē-ël dôr-sā, COMTE, French leader of fashion: b. Paris 4 Sept. 1801; d. there

## DORSE — DORY

4 Aug. 1852. In 1822 he became acquainted with Lord and Lady Blessington, and renounced his military career for the pleasure of their society. In 1827 he married Lord Blessington's only daughter by a first marriage, but a separation shortly followed, and Lord Blessington having died in 1829, D'Orsay returned to England with Lady Blessington, where they became the centre of a circle distinguished for art, rank, literature, and accomplishments.

**Dorse**, a small codfish found in the Baltic. Formerly supposed to be a distinct species (*Gadus callarias*), but now believed to be the young of the common codfish.

**Dorsetshire**, a maritime county of England; area, 632,272 acres. Portland stone is quarried in this county.

**Dorsey, Anna Hanson**, American poet, novelist, and dramatist: b. Georgetown, D. C., 12 Dec. 1815; d. Washington, D. C., 26 Dec. 1896. Some of her works were reprinted in foreign countries; among them being: 'May Brooke' (1856); and 'Oriental Pearl,' translated into German (1857). Her novels, 'Warp and Woof,' and 'Palms,' were published in 1887.

**Dorsey, Ella Loraine**, American author: b. Washington, D. C., 2 March 1855. She early devoted herself to journalism, serving for 10 years on the Washington papers and later in several other cities. She began her specialty of Catholic juvenile fiction in 1886. She has written much prose and verse for the magazines, and among her published books are: 'Midshipman Bob'; 'Jet, the War Mule'; 'The José Maria'; 'Saxby's Angels'; and the 'Two Tramps.'

**Dorsey, James Owen**, American ethnologist: b. Baltimore, Md., 31 Oct. 1848; d. Washington, D. C., 4 Feb. 1895. He was ordained a deacon in the Protestant Episcopal Church, and was engaged in parish work in Maryland from 1873-8. He was then appointed ethnologist to the United States Geological and Geographical Survey of the Rocky Mountains; and after spending some time at the Omaha Reservation in Nebraska, was transferred to the United States Bureau of Ethnology. His chief works are: 'On the Comparative Phonology of Four Siouian (Sioux) Languages' (1883); 'Siouian Folklore and Mythologic Notes' (1884); 'Kansas Mourning and War Customs' (1884); 'Indian Personal Names' (1886).

**Dorsey, Sarah Anne**, American prose-writer: b. Natchez, Miss., 16 Feb. 1829; d. New Orleans, La., 4 July 1879. She was a linguist and a student of Sanskrit. Included in her writings are: 'Lucia Dare' (1867); 'Panola, a Tale of Louisiana' (1877); 'Atalie'; and 'Agnes Graham.' She was amanuensis to Jefferson Davis in the preparation of his 'Rise and Fall of the Confederate Government.'

**Dorsey, Stephen Wallace**, American politician: b. Benson, Vt., 28 Feb. 1842. He served in the Federal army during the Civil War, and subsequently removing to Arkansas was active in politics. He was a member of the Republican State and county committees; was elected to the United States Senate in 1873; and was secretary of the Republican National Committee for the campaign of 1880. At the time of the "star route" exposures he was accused of having in-

fluenced legislation in the Senate, was indicted before the grand jury in Washington; but was acquitted on his second trial. After 1880 he withdrew from politics.

**Dorste'nia** (named after Dr. Dorsten, a German botanist), a genus of plants of the natural order *arlocapaceae*, natives of tropical America. The genus is remarkable for the receptacle in which the numerous small flowers are sunken, the female flowers being the most depressed. The rootstocks of various species are used in the preparation of a medicine, once in much repute against low fevers, and as a mild stimulant and diaphoretic, also as efficacious against snake bites, whence the Spanish name, *contra-gerva*.

**Dort**, dôrt, or **Dordrecht**, dôr'drênt, Holland, city in the province of South Holland; 10 miles southeast of Rotterdam. An inundation in 1421, in which upward of 70 villages were destroyed and 100,000 people drowned, separated the site on which Dort stands from the mainland. It was founded in 1013. Here, in 1572, the states of Holland, after the revolt from Spain, held their first assembly; and sat from 13 Nov. 1618 to 19 May 1619, the conclave of Protestant divines known as the Synod of Dort, which condemned the doctrines of Arminius as heretical, and affirmed those of Calvin. Dort is the birthplace of the brothers De Witt of Cuyp, and Ary Scheffer; to the last a statue was erected in the market-place in 1862. Pop. (1900) 38,804.

**Dort, Synod of**, an assembly of Protestant divines convoked at Dort (Dordrecht) in 1618-19. Besides the Dutch and Walloon divines, it included representatives from England, Scotland, Switzerland, and part of Germany. It was chiefly occupied in considering the doctrines of Arminius (see ARMINIANISM). It originated the project of translating the Bible into Dutch, which was executed after 19 years' labor. The translation is known as the 'Dort Bible.'

**Dortmund**, dôrt'moont, Germany, city in the province of Westphalia, on the Ems, 47 miles north-northeast of Cologne. In 1899 it was connected by canal with the canalized Ems (giving a waterway to Emden on the North Sea), and extensive harbor accommodation has been provided. It owes its recent great and increasing prosperity to its becoming the centre of several important railway systems, to the opening of extensive coal mines in the vicinity, and to the active manufactures of iron, steel, machinery, railway plant, etc. It was once a free imperial and Hanseatic town, and the seat of the chief tribunal of the Vehm. Pop. (1900) 142,418.

**Dorus**, the eponymous ancestor of the Dorians.

**Dory**, or **John Dory** (*Zeus faber*), a fish belonging to the family *Zenidae*, somewhat allied to the mackerel, and celebrated for the delicacy of its flesh. It has the spinous portions of the dorsal and anal fins separated by a deep emargination from the soft-rayed portion, and has also the base of all the vertical fins, and the carina of the belly anterior to the anal fin, furnished with spines or serratures; color, yellowish-green, with a blackish spot on each side; dorsal and anal fins with furcate spines, and a long filament produced from behind each dorsal spinous

ray. The dory has exceedingly protractile jaws, which enable it to capture small fish, etc., when concealed in the ooze or weeds, after slowly moving upon them in a stealthy, catlike manner. It is found on the coast of England, and on the Atlantic shores of Europe, and in the Mediterranean. A related species (*Zenopsis ocellatus*) has been once taken on our coasts at Provincetown, Mass.

Also a North Atlantic species of rock-fish (q.v.).

**Dos Passos, John R.**, American lawyer: b. Philadelphia 1854. He is of Portuguese descent. He studied law; served in the Federal army during the Civil War, and after practising law in Philadelphia for some time went to New York in 1867, where he was very successful in the criminal branch of practice. Later he became an authority upon banking, corporate and financial law. He has written considerably. Among his published works are: 'A Treatise on the Law of Stock Brokers and Stock Exchanges' (1882); 'The Interstate Commerce Act' (1887); 'Commercial Trusts'; 'The Anglo-Saxon Century' (1903).

**Dōseh, dō'sē**, an Arabic word meaning "treating" denotes a remarkable ceremony, which, until its suppression in 1884, used to take place in Cairo annually on the feast of the prophet's birth (Moolid), in the third month of the Mohammedan year. A party of dervishes of the Sa'di order, to the number of a hundred or more, lay down on their faces, side by side, with their arms doubled under their foreheads. A dozen more ran along upon their comrades' prostrate backs, beating drums, and shouting "Allah." Then the sheikh, mounted, rode along upon the line of bodies, from whom audible prayers could be heard proceeding. It was in consequence of evidences of considerable injury inflicted by the iron-shod hoofs that the khedive Tewfik suppressed this singular religious rite. See E. W. Lane, 'Modern Egyptians,' xxiv.; Butler, 'Court Life in Egypt.'

**Dositheans** (from their founder, Dositheus), a sect founded by Dositheus, whose life and labors were in Samaria. The popular belief is that he was the first Christian "heretic." Mosheim, on the contrary, thought that he was not a Christian at all, but a false Messiah, who lived at or about the time of our Lord. He is said to have been very rigid in his Sabbatarianism. His other opinions were partly Samaritan, partly Sadducean.

**Dositheus**, Jewish heresiarch of the 1st century A.D. He insisted on a painfully rigorous observance of the Sabbath, and died of excessive fasting. There was also a grammarian of this name in the 4th century, who wrote a Latin grammar for Greek boys.

**Dosso Dossi, dōs'sō dōs'sē** (properly GIOVANNI DI NICOLÒ LUTERO), Italian painter: b. near Mantua 1479; d. Ferrara 1542. His manner approaches to that of Titian, with whom he painted some apartments in the ducal castle. His paintings there represent bacchanals, fauns, satyrs, and nymphs. In other paintings he imitated Raphael. Among eight of Dossi's pictures in Dresden, the 'Dispute of the Four Doctors of the Church' is distinguished as a masterpiece by accurate delineation and peculiar power of coloring, and is entirely

in the style of Titian. His brother, Giovanni Battista (d. 1546) was a less celebrated painter.

**Dost, Mohammed Khan**, Afghan usurper: b. about 1790; d. 1863. He obtained possession of the throne of Afghanistan after the flight of Mahmud Shah in 1818; ruled with great ability, and although driven from his throne by a British army, was ultimately restored, and later became a steady supporter of British power in the East.

**Dostoyevsky, Feodor Mikhailovitch, fā'ō-dōr mī-kāl'ō-vich dōs-tō-yēf'skī**, Russian novelist: b. Moscow 11 Nov. 1821; d. St. Petersburg 9 Feb. 1881. After serving as an officer of engineers he devoted himself to literature, but becoming connected with communistic schemes was banished to the mines of Siberia, from which he returned in 1856 to resume his literary activity. His first novel, 'Poor People,' came out in 1846, and an English translation of it appeared in 1894. Among other of his works that have appeared in English are 'Crime and Punishment' (1868), a very powerful work, characterized by masterly psychological analysis and thrilling realism in description; 'Injury and Insult'; 'The Friend of the Family'; 'The Gambler'; 'The Idiot'; 'Prison Life in Siberia.' A complete edition of his works was published (1882-3).

**Dotheboys Hall**, the school which figures in Dickens' novel, 'Nicholas Nickleby.' It was kept by Squeers (q.v.). The name is a rendering of Do-the-Boys Hall. The effect of the exposure by Dickens of the conditions prevailing in some of the English boys' schools was a complete reformation in their methods and management.

**Doto**, one of the Nereids.

**Dotterel** (*Charadrius-* or *Eudromias-morinellus*), a species of plover (q.v.) which breeds in the north of Europe and returns to the south for the winter. It is found all over Europe and northern Asia. The dotterel has always been highly esteemed for the table, but its extermination in Great Britain is more likely to result from the assiduity of the egg collector than of the sportsman, a consummation likely to be hastened from its habit of laying but three eggs, instead of four like most plovers. It likewise differs from all other species of plover in having the sternum fenestrated instead of notched posteriorly, and in the larger size and brighter colors of the female.

**Dou, Gerard.** See DOW, GERARD.

**Douai.** See DOUAY.

**Douarnenez, doo-ār-nē-nēs or -nēz**, France, a port in the department of Finistère, on the Bay of Douarnenez, eight miles northwest of Quimper by rail. It is important for the sardine fishery. Pop. 12,900.

**Douay, doo-ā, or Douai**, France, city in the department of Nord, on the Scarpe River, 18 miles south of Lille. It is one of the oldest towns in France. Its manufactures and trade are quite important. It is noted for the schools which were established here in the 16th and 17th centuries. English, Scottish, and Irish colleges, and novitiates of English Franciscans and Benedictines were all affiliated with the Douay University. Printing-presses and libraries furnished an opportunity for publishing



books for English Catholics. The university property was confiscated in 1793, in the revolutionary period; students and teachers fled to England, and to this migration the Roman Catholic college at Ushaw, near Durham, owes its origin. The English Benedictines still have an establishment at Douay. The library now in the town contains about 90,000 volumes and many valuable manuscripts. Pop. 32,146. See DOUAY BIBLE.

**Douay Bible**, the name commonly given to the version of the Vulgate text of the Scriptures made at Rheims in France for the use of English-speaking Catholics. The translators and editors of this version were Dr. William (afterward Cardinal) Allen, Dr. Gregory Martin, Dr. Richard Bristow, and John Reynolds, all of them alumni of Oxford University. The work of translating was done mostly by Dr. Gregory Martin, "a scholar of distinguished attainments both in Greek and Hebrew," says the eminent biblical critic, Dr. Westcott. The New Testament was published at Rheims in 1582 and the Old at Douay in 1609-10, both in quarto. The text has since that time undergone numerous revisions, chiefly for correction of its literary form which was faulty because of the employment of words of Latin origin and unintelligible for readers unacquainted with Latin, instead of the homely English equivalents, for example, "comessations" (revellings), ebriety, impudicity, agnition, coinquination, contristate, donary, exinanite, suasible: all mere Latin words with English terminations. This very serious fault was in revision after revision corrected with greatest thoroughness by Dr. Challoner (q.v.), whose first edition of the revised New Testament was published in 1749 and that of the Old Testament in the following year. Challoner's final revision has itself undergone revision several times since, but only for correction of minor errors and oversights. Despite its very serious defects the original Rhemish translation has elicited from a most competent judge, Dr. Westcott, "History of the English Bible," the praise of great fidelity to the text of the Vulgate. "The Rhemists," he says, "in their scrupulous and even servile adherence to the text of the Vulgate . . . frequently reproduced with force the original order of the Greek, which is preserved in the Latin; and even while many unpleasant roughnesses occur there can be little doubt that this version gained on the whole by the faithfulness with which they endeavored to keep the original form of the sacred writings. . . . The same spirit of anxious fidelity to the letter of their text often led the Rhemists to keep the phrase of the original when others had abandoned it. . . . When the Latin was capable of guiding them the Rhemists seem to have followed out their principles honestly; but whenever it was inadequate or ambiguous, they had the niceties of Greek at their command."

**Double Bass or Base**, sometimes called contrabass, is the largest and deepest voiced of the viol family. Though seldom used in solo work it is counted one of the foundations of the modern orchestra. Originally it had only three strings, but used to-day with four, from the pitch of the third E below the violin clef. The strings are tuned a fourth apart. It probably derives its name from the fact that it sometimes doubles

the bass given to the 'cello or similar instrument in a score. It first appeared in the 16th century and has been attributed to the inventive genius of Gasparo da Salo.

**Double Bassoon**, also known as contra-fagotto, stands in the same relation to the oboe family as the double-bass (q.v.) does to the stringed instruments, being the largest and deepest toned. It has a compass of more than three octaves upward from the third C (and even Bb) below middle C; an octave lower than the ordinary bassoon. It has a conical tube over 16 feet in length, but bent up so compactly that it causes no inconvenience to the player. Many great masters of orchestration have written liberally for it, especially Haydn, Beethoven, Spohr, and Mendelssohn.

**Double Consciousness**, a peculiar mental condition, illustrated by the celebrated story of Dr. Jekyll and Mr. Hyde, which describes a rare type of phenomenon occasionally met with in certain nervous affections. By double consciousness is meant, that at certain times, in the waking consciousness of the individual, certain dominant ideas control and impart to the individual a definite personality, known and recognized as such by his friends and associates, and that, at other times, also in a distinctly conscious state, an entirely different series of ideas may govern the person, making him think, feel, and act in a manner entirely different from that of his former personality. It would seem, from many recent studies concerning this phenomenon, that it is practically always a symptom of a diseased mental state and that one of the personalities, so-called, is distinctly pathological and does not pertain to the ordinary conscious states, but is a symptom of a hysterical or epileptic attack. Hypnotic double consciousness is difficult to write about, inasmuch as a large proportion of the observations made by seemingly reputable observers are plainly fictional; but there remains, over and above such untrustworthy accounts, a certain residue of observations which would tend to show that a true double consciousness might exist in the hypnotic phenomenon. Of course it is understood that in normal life, different phases of feeling come and go, and that all normal people do not feel the same at all times, but there is rarely in normal life the marked distinction between two phases of mental activity, such as is described as characterizing the phenomenon of double consciousness. In certain forms of psychical epilepsy, there is a phenomenon of great interest, the so-called automatic epileptic condition, during which the patient may be absolutely different from his former self. This state in epilepsy may persist for a few moments, a few hours, a few days or even extend for weeks. While in this condition the patient may act in a manner totally foreign to his previous self. It is probably true that the nucleus of the condition known as double consciousness must be found in the study of these automatic states that occur in epilepsy. Trance conditions, cataleptic phenomena, somnambulistic performances, etc., are certainly allied states, a complete judgment on which, however, must be reserved for future study. See Gower, 'Epilepsy'; Löwenfeld, 'Der Hypnotismus'; 'Annales des Sciences Psychiques.'



## DOUBLE DRAGON — DOUBLE STARS

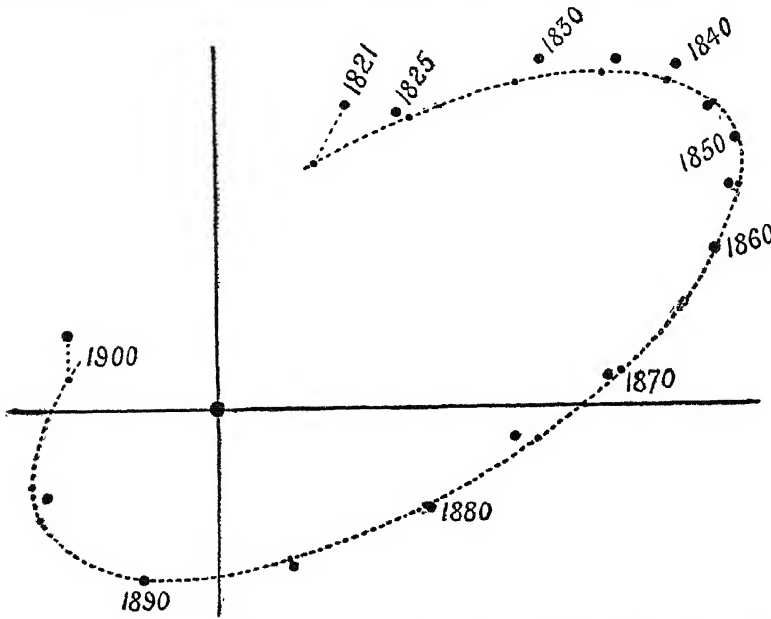
**Double Dragon, Order of the,** a military order of China, established to honor foreigners who had served China in a military capacity. In 1882 it was made to include other foreigners who had rendered service to the nation.

**Double Eagle,** a United States coin of the value of \$20, the eagle being \$10. The name is a book-word, the popular term being "twenty-dollar gold piece." The piece was authorized by Congress in March 1849, and the first ones were struck in 1850. The name refers to the figure of the eagle upon it. It was one of the coins authorized by the Act of 1873.

**Double Flowers** are flowers which, usually through cultivation, have their stamens and pistils developed into petals, by which the beauty of the flower may be enhanced, though its reproductive powers are sacrificed. All intermediate stages between stamens and petals can be seen in double-flowered roses and carnations. It is frequently observed that a multiplication of the leaf accompanies the conversion of stamens into

systematic study of these objects was made by Sir William Herschel, who, between the years 1779 and 1784, made extensive catalogues of them, because he thought it likely that they were only optically double, one component being really much more remote than the other, and the apparent duplicity being due to the fact that the two lie almost in the same straight line with us. If that were the case, the earth's orbital motion about the sun might be great enough to make an appreciable variation in the distance or direction of one star from the other, if the system were viewed at different times in the year. After recording the distances between many of these stars, as well as the direction of the line joining the two components, he went over them again to see if any changes could be noted; and in so doing (as his son, Sir John Herschel has recorded) "his attention was altogether diverted from the original object of the inquiry by phenomena of a very unexpected character, which at once engrossed his whole attention." Instead

of finding an annual and alternate increase and decrease of the distance, and a corresponding periodic variation in their direction, he saw that in many cases there was a continuous change in both, advancing steadily in one direction. If this were due to the fact that the solar system and the two components of the double star were moving independently through space, we should expect the motion of either of the components, relatively to the other one, to be sensibly rectilinear. After the lapse of 25 years Herschel became satisfied that this is not always



petals; so that a single stamen may be represented by two or more petal-like leaves. Double flowers remain fresh two, three, even eight days longer than similar normal single flowers.

**Double Standard,** in economics the phrase double standard is used to signify a double standard of monetary value fixed by legislative enactment. It implies the existence of what is known as the gold standard on the one hand, and the silver standard on the other. Wherever the double standard in its integrity is in use a creditor is bound to accept payment of any sum in coins of either of the metals, gold or silver, which the debtor may choose to tender. See **BIMETALLISM**.

**Double Stars** are stars which, while they may appear single to the eye, are known, by telescopic observation, to consist of two constituents that are near enough together to justify the assumption of a physical connection. About 10,000 such stars are known. The first

the case, for in some instances he found good evidence of actual orbital motion, and in 1802 he announced that "there exist sidereal systems, composed of two stars revolving about each other in regular orbits," in the same manner that the earth revolves about the sun, or the moon about the earth. About the year 1819 William Struve took up the systematic study of these stellar systems, and made a long series of most excellent measures of them covering a period of many years. Subsequently the work was taken up by other skilled observers, and we now have a vast mass of data of this sort, from which fairly good orbits of some of the systems have been obtained. The most comprehensive book on the subject is Crossley, Gledhill and Wilson's 'Handbook of Double Stars,' which is a treasury of numerical data and references, and also contains methods for computing the orbits of double stars, as well as advice concerning the making of observations. The star known to astronomers as "70 Ophiuchi" may be cited as

an example of a binary whose orbit has been determined with some degree of approximation. In reality, both of the components of a double star are in motion, each revolving about the common centre of gravity of the two; but it is known that in a system composed of two bodies revolving about each other no error is committed, so far as the relative motion of the two is concerned, by regarding one of them as fixed, and assuming that the other revolves about it. It is customary, therefore, to regard the brighter component of such a star as fixed. In the case of 70 Ophiuchi one star is of about the fourth magnitude, while the other is of about the sixth. In the diagram the large black spot at the intersection of the two straight lines represents the larger star, the straight lines themselves representing, respectively, a meridian and a declination-circle passing through it. The dotted ellipse represents the apparent orbit of the component star, as computed by Risteen from all the available data up to the year 1895. The large dots that appear irregularly along the ellipse, being sometimes within it and sometimes without, represent the observed positions of the companion star, for every five years; and the corresponding smaller dots that lie exactly upon the ellipse represent the corresponding positions of the component, as calculated from Risteen's orbit. (The orbit itself is based upon observations taken each year; but the observations intermediate to those shown have been omitted from the diagram in the interest of clearness.) According to the computation here cited, the period of revolution of 70 Ophiuchi is 88.42 years. In addition to the stars that are visibly double when viewed through the telescope, numerous stars are now known which have been proved to be double by means of spectroscopic observations. (See DOPPLER'S PRINCIPLE.) The periods of revolution of some of these are exceedingly short. Thus, one of the components of the telescopically double star Kappa Pegasi is itself a spectroscopic binary with a period of only six days.

**Doubleday, Abner**, American military officer: b. Ballston Spa, N. Y., 26 June 1819; d. Mendham, N. J., 26 Jan. 1893. He was graduated at the United States Military Academy in 1842, rising to the rank of colonel in 1870 (brevet lieutenant-colonel in 1865). He was second in command at Fort Sumter in 1861, firing the first gun in its defense, and he greatly distinguished himself at Gettysburg. He published: 'Reminiscences of Forts Sumter and Moultrie in 1860-1' (1876); 'Chancellorsville and Gettysburg' (1882).

**Doubleday, Neltje Blanchan**, American author: b. Chicago 23 Oct. 1865. She was married to F. N. Doubleday in 1886. She has published: 'The Piegan Indians' (1894); 'Bird Neighbors' (1897); 'Birds that Hunt and are Hunted' (1898); 'Nature's Garden: Our Wild Flowers and Their Insect Visitors' (1900).

**Doubleday, Russel**, American author: b. Brooklyn 26 May 1872. He was educated in private schools, and served in the United States navy during the Spanish-American war 1898. He has written: 'A Gunner Aboard the Yankee'; 'Cattle Ranch to College.'

**Doublet**, a close-fitting garment, covering the body from the neck to a little below the waist. It received its name from being originally

lined or wadded for protection. At first it had short skirts, but these diminished as the body of the garment became fuller and more elaborate under the reign of Queen Elizabeth. During the period of Charles I. and after Charles II. it lost all pretense and dwindled into a sleeveless jacket, the forerunner of our modern waistcoat. Originally was introduced from France into England in the 14th century.

In lapidary work, a counterfeit stone composed of two pieces of crystal, with a color between them, so that they have the same appearance as if the whole substance of the crystal were colored. Again accomplished another way by taking a thin layer of a precious gem and fastening it on the line of the girdle to a piece of glass colored to match. Some invisible cement is employed for the purpose, such as gum mastic.

**Doubling the Cube**, a celebrated problem among the ancient Greek geometers. According to legend the problem originated in an oracle of Apollo delivered to the people of Delos, and hence it has been called the Delian problem. The altar of Apollo at Delos was a cube, and once when they had offended him he ordered that the size of it should be doubled. This was easily done, but had no effect in mitigating the pestilence, which was the usual consequence of Apollo's wrath. On applying to him again the reply was that they must not change the shape of the altar. Hence arose the problem to find the exact size of the side of a cube the contents of which should be twice that of another given cube. The problem, however, was not invented by Apollo, he had only cunningly taken advantage of a problem which had already occupied Hippocrates of Chios and other Greek geometers. This problem the Greek geometers failed to solve, although their efforts to do so proved useful in advancing the study of geometry. It is indeed incapable of arithmetical solution, as will be made clear by merely examining the cubes of the first few numbers consecutively.

The cubes of the numbers from 1 to 9 are:

1	2	3	4	5	6	7	8	9
1	8	27	64	125	216	343	512	729

Here it is evident that taking any given arithmetical unit, it is impossible to find a number depending on it of which the cube will be double that of the cube of any other number depending on the same unit. If, for example, the side of Apollo's altar measured 3 feet, the cubic content of the doubled altar would have to be 54 feet; but it is clear that no whole number will give 54 as its cubic, and as no fraction multiplied by itself will give a whole number, the exact dimensions of the side of this doubled altar cannot be given either in whole feet or in any finite fraction of a foot. This does not prove, however, that a cube of this size cannot exist, but only that between its side and that of a cube whose side is three feet no definite arithmetical ratio can be fixed.

**Doubloon**, düb-loon', a gold coin of Spain, equal in value to two pistoles. It was worth 1730 to 1772 about \$8.24, from 1772 to 1786, \$8.08, and from 1786 to 1848, \$7.87. Although the coinage of the doubloon has ceased in Spain, coins still current are valued at \$5.02.

**Doubs**, doo, France, (1) a department which is traversed by four chains of the Jura. Pop.

## DOUBTING CASTLE — DOUGLAS

305,193. (2) Doubs, a river 250 miles in length, rises in this department.

**Doubling Castle**, the castle in 'Pilgrim's Progress,' where Christian and his companion Hopeful are imprisoned for a time by Giant Despair.

**Doubling Insanity**. See **INSANITY**.

**Douc**, dook, a species of small monkey (*Semnopithecus nemous*), native to Cochinchina. It is curiously marked with red, white, and black.

**Doucet, Charles Camille**, shārl kă mēl doo-sā, French dramatist: b. Paris 16 May 1812; d. there 1 April 1895. He became in 1853 a government official in the theatrical department; was elected to the Academy in 1876, and soon after made its standing secretary. The best known of his many very successful comedies are: 'A Young Man' (1841); 'Lawyer in His Own Cause' (1842); 'Forbidden Fruit' (1857); 'Consideration.' His lyric pieces for the stage, 'Velasquez' (1847), and 'Antonio's Barque' (1849), were crowned by the Academy.

**Doucet, Henri Lucien**, ōh-rē lū-sē-ōh, French painter: b. Paris 23 Aug. 1856. He was a pupil of Lefebvre and Boulanger; and won the Prix de Rome in 1880. Among his paintings are: 'Adam and Eve'; 'Atala'; 'Après le Bal'; 'Hagar'; and a number of portraits, including one of Mme. Galli Marie of the Opéra Comique.

**Doudney, Sarah**, English novelist: b. Portsmouth 15 Jan. 1843. She began writing when quite young and has published: 'A Woman's Glory' (1885); 'The Missing Rubies' (1886); 'When We Two Parted' (1887); 'Strangers Yet'; 'Stepping Stones'; 'The Strength of Her Youth'; 'Thy Heart's Desire'; 'Where Two Ways Meet'; 'Under False Colours'; 'Nothing but Leaves'; 'Miss Willowburn's Offer'; 'Where the Dew Falls in London' (1890); 'Through Pain to Peace' (1892); 'A Romance of Lincoln's Inn' (1894); 'Katherine's Keys' (1895); 'Pilgrims of the Night' (1896); 'A Cluster of Roses'; 'Lady Dye's Reparation' (1899); 'Silent Strings' (1900); 'Godiva Durlough'; 'Child of the Precinct.'

**Dougall, Lily**, Canadian novelist: b. Montreal, Canada, 16 April 1858. She has published: 'Beggars All' (1891); 'What Necessity Knows' (1893); 'The Mermaid' (1895); 'The Madonna of a Day' (1896); 'A Dozen Ways of Love' (1897); 'The Mormon Prophet' (1898).

**Dough'bird**, a name given to several species of curlew (q.v.), but more especially to the Eskimo curlew (*Numenius borealis*).

**Doughface**, a nickname applied to northern politicians who were inclined to yield to the southern States in the antebellum agitation over States' rights and slavery. The term is traced back to 1820, when it was applied to the Northerners who supported the Missouri Compromise (q.v.).

**Doughty, Thomas**, American landscape painter: b. Philadelphia 19 July 1793; d. New York 24 July 1856. He was apprenticed in his youth to a leather manufacturer, and afterward carried on the business on his own account. A growing taste for art, however, induced him

to become a painter. He practised his profession for many years in the United States, and also in London and Paris.

**Douglas**, Scottish noble family. Their origin is unknown. They were already territorial magnates at the time when Bruce and Baliol were competitors for the crown, and like most of the Scottish nobility did homage and took oaths of allegiance to Edward I. They had estates both in England and Scotland, but chiefly in Scotland. One of them, William Douglas, joined Wallace. As their estates lay on the borders they early became guardians of the kingdom against the encroachments of the English, particularly of the Percies, who occupied a similar position on the English border, and acquired in this way power, habits, and experience which frequently made them formidable to the crown. The most important members of this family in chronological succession are:

**JAMES**, son of the William Douglas who had been a companion of Wallace, and is commonly known as the Good Sir James, early joined Bruce, and was one of his chief supporters throughout his career, and one of the most distinguished leaders at the battle of Bannockburn. He fell in battle with the Moors while on his way to the Holy Land with the heart of his master, in 1331.

**ARCHIBALD**, youngest brother of Sir James, succeeded to the regency of Scotland in the infancy of David. He was defeated and killed at Halidon Hill by Edward III. in 1333.

**WILLIAM**, son of the preceding, was created first earl in 1357. He recovered Douglasdale from the English, and was frequently engaged in wars with them. He fought at the battle of Poitiers. He died in 1384.

**JAMES**, the second earl, who, like his ancestors, was constantly engaged in border warfare, was killed at the battle of Otterburn in 1388. After his death the earldom passed to an illegitimate son of the Good Sir James, Archibald the Grim, Lord of Galloway.

**ARCHIBALD**, son of Archibald the Grim and fourth earl, was the Douglas who was defeated and taken prisoner by Percy (Hotspur) at Homildon, 14 Sept. 1402. He was also taken prisoner at Shrewsbury, 23 July 1403, and did not recover his liberty till 1407. He was killed at the battle of Verneuil, in Normandy, in 1427. Charles VII. created him Duke of Touraine, which title descended to his successors.

**WILLIAM**, sixth earl, b. 1422, together with his only brother, David, was assassinated by Crichton and Livingstone at a banquet to which he had been invited in the name of the king, in Edinburgh Castle, 24 Nov. 1440. Jealousy of the great power which the Douglasses had acquired from their possessions in Scotland and France was the cause of this deed.

**WILLIAM**, the eighth earl, a descendant of the third earl, restored the power of the Douglasses by a marriage with his cousin, heiress of another branch of the family; was appointed lord-lieutenant of the kingdom, and defeated the English at Sark. Latterly having entered into a treasonous league, he was invited by James II. to Stirling and there murdered by the king's own hand, 22 Feb. 1452.

**JAMES**, the ninth and last earl, brother of the preceding, took up arms with his allies to avenge his death, but was finally driven to England,

## DOUGLAS

where he continued an exile for nearly 30 years. Having entered Scotland on a raid in 1484 he was taken prisoner and confined in the abbey of Lindores, where he died in 1488. His estates, which had been forfeited in 1455, were bestowed on the fourth Earl of Angus, the "Red Douglas," the representative of a younger branch of the Douglas family, which continued to flourish long after. The fifth Earl of Angus, Archibald Douglas, was the celebrated "Bell-the-Cat," one of whose sons was Gawin Douglas, the poet. He died in a monastery in 1514. Archibald, the sixth earl, married Queen Margaret, widow of James IV., attained the dignity of regent of the kingdom, and after various vicissitudes of fortune, having at one time been attainted and forced to flee from the kingdom, died about 1560. He left no son, and the title of Earl of Angus passed to his nephew, David. James Douglas, brother of David, married the heiress of the Earl of Morton, which title he received on the death of his father-in-law. His nephew, Archibald, eighth Earl of Angus and Earl of Morton, died childless, and the earldom of Angus then passed to Sir William Douglas of Glenbervie, his cousin, whose son William was raised to the rank of Marquis of Douglas. Archibald, the great-grandson of William, was raised in 1703 to the dignity of Duke of Douglas, but died unmarried in 1761, when the ducal title became extinct, and the marquise passed to the Duke of Hamilton, the descendant of a younger son of the first marquis. The line of Angus or the Red Douglas is now represented by the houses of Hamilton and Home, who both claim the title of Earl of Angus.

**Douglas, Alice May**, American writer for young people: b. Bath, Maine, 28 June 1865. Her writings include in verse: 'Phlox'; 'May Flowers'; 'Gems Without Polish'; in prose: 'Jewel Gatherers'; 'The Peacemaker'; and 'Self-Exiled from Russia,' etc.

**Douglas, Amanda Minnie**, American author: b. in New York 14 July 1837. She has written about 30 novels besides doing other literary work. Among her novels are: 'In Trust'; 'Claudia'; 'Stephen Dane'; 'From Hand to Mouth'; 'Out of the Wreck'; 'A Woman's Inheritance'; 'Osborne of Arrochar' (1883); 'Her Place in the World' (1894). She has also written several juvenile tales.

**Douglas, David**, Scottish botanist: b. Scone, Perthshire, 1798; d. Hawaii 12 July 1834. In the botanical garden at Glasgow, he attracted the notice of Sir William Hooker, the professor of botany, who recommended him as a botanical collector to the Horticultural Society of London. He was accordingly, in 1823, sent by the society to the United States, where he procured many fine plants, and in particular increased the society's collection of fruit-trees. In 1824 he was sent on a second mission to explore the vegetation of the country adjoining the Columbia River, and southward toward California. In making the voyage he never lost sight of his object, and was able, during the short time the vessel touched at Rio Janeiro, to collect many rare orchidaceous plants and bulbs. He arrived at Fort Vancouver in 1825, and sent home, from time to time, many beautiful plants, with seeds and dried specimens. A species of pine of gigantic size, one of several which he discovered, bears his name, *Pinus Douglasii*.

**Douglas, Gawin**, Scottish poet: b. Brechin about 1474; d. London 1522. He was the son of Archibald, earl of Angus ("Bell-the-Cat"). Having taken orders in the church, he received the living of Prestonkirk, near Dunbar, and was also made provost of St. Giles, Edinburgh. In 1516 he was installed Bishop of Dunkeld, but had an uneasy tenure of office; and having gone to England, was deprived of his bishopric. Gawin Douglas' great work is a translation of the *Æneid* of Virgil (with the supplementary book of Maphæus) in heroic verse. It is executed with great spirit, and considering the age, with extraordinary elegance of diction. It was written about 1512, and is said to have been completed in 18 months. To each book is prefixed a highly poetical prologue. It was first published in 1553. Douglas also wrote 'The Palace of Honor' and 'King Hart,' both allegorical poems. A complete edition of his poems was published 1874.

**Douglas, Henry Kyd**, American author and jurist: b. Shepherdstown, W. Va., 29 Sept. 1840; d. Hagerstown, Md., 18 Dec. 1903. He was graduated at Franklin and Marshall College (1859), at the time when James Buchanan, afterward President of the United States, was a member of the faculty. He enlisted at Harper's Ferry in the Confederate Army as a private in Company B of the noted "Stonewall" Jackson Brigade. He took part in the battle of Bull Run, and for his bravery was promoted until he rose to be a captain. In March 1862 he made a ride of 103 miles in order that Gen. Ewell might at once join Jackson. This ride became celebrated in history. Horses were changed five times, and the ride was made through rain and mud. On his return he was promoted to inspector-general by Stonewall Jackson, with whom he served in every battle. At Gettysburg he was seriously wounded and was in prison nine months. His brigade was the last to surrender. Douglas was wounded nine times.

**Douglas, John**, English prelate: b. Pittenweem, Fifeshire, Scotland, 14 July 1721; d. Salisbury, England, 18 May 1807. He was educated at Oxford and in 1762 he was made Canon of Windsor, which benefice he exchanged for a residentiary canonry of St. Paul's. In 1751 he wrote 'Milton Vindicated from the Charge of Plagiarism.' In 1777 he prepared for the press the journal of Captain Cook's second voyage, to which he prefixed a well-written introduction, and added notes. In 1778 he was elected a Fellow of the Royal and Antiquarian Societies; and in 1781 he edited the account of Capt. Cook's third voyage. In 1787 he was raised to the see of Carlisle, and in 1792 was made Bishop of Salisbury.

**Douglas, Robert Kennaway**, English librarian and educator: b. Ottery Sainte Mary, Devon, 23 Oct. 1838. In 1873 became professor of Chinese at King's College, London. Among his publications are: 'Life of Li Hung Chang' (1895); 'China' (1899).

**Douglas, Stephen Arnold**, American politician: b. Brandon, Vt., 23 April 1813; d. Chicago, 11 June 1861. His father, a physician, died three months after his birth, and his mother was left with scanty means of support. At the age of 15 he apprenticed himself to a cabinet-maker and worked for two years at the latter's trade. Then, after a short term of study at the

## DOUGLAS

Brandon Academy, he accompanied his mother, who had married again, to a new home, near Canandaigua, N. Y., where he finished his schooling at an excellent academy, and where he began the study of law. He was interested deeply in political questions, even in these years, attaching himself with ardor to the new party of Democracy which Gen. Jackson was then molding into form. In 1833 he left Canandaigua to seek a career in the West, and, after several months of ill-health and hardship, found employment for the winter in school-teaching at Winchester, Ill. In the spring of 1834 he was admitted to the Illinois bar and settled himself at Jacksonville, in that State. From that time his rapid rise to prominence was extraordinary, even among careers of ambition in the young West. Physically delicate and short in stature, his small body was so strikingly in contrast with the power massed in a big brain and exercised by an indomitable will that admiring Jacksonville promptly gave him the name of the "Little Giant," which clung to him through life. Almost at once he became the acknowledged leader of his party in the town. A winning personality, an elastic temper, a fearless and ardent spirit, unbounded self-confidence and surpassing energy of intellect and will, were qualities that carried him always to the place of command. Within a year from his settlement at Jacksonville he was prosecuting attorney for his district; within two years he was seated in the legislature of the State; and from his service of a session in that body he passed into the office of United States Register of Public Lands, at Springfield, to which he was appointed by President Van Buren in 1837. His residence was at Springfield for the next 10 years, and there he came to acquaintance with Abraham Lincoln, his great political antagonist of a later time, whose rise to eminence was much slower than his own. In 1838 the bold young Jacksonian very nearly won an election to Congress in the strongly Whig district to which Springfield belonged. In 1841 he was appointed to a judgeship in the supreme court of the State, but resigned his seat on the bench two years later, to present himself again as a candidate for Congress, and with success. At that time (1843) he had just passed his thirtieth year. Most newcomers in Congress, even the ablest, need time to make a position of influence for themselves; but Douglas was prominent among the Democratic representatives of the Northwest from the first. The vigorous activity of his mind and the remarkable quickness of its working, made him formidable in debate; while the unhesitating resoluteness with which he threw himself into whatever he undertook carried him always to the front of the fighting line. At the beginning of his second term in the House of Representatives he was made chairman of its Committee on Territories; and when, at the end of that term, he was elected to the Senate (1845), he received the chairmanship of the same committee in that body. This gave him the direction of subjects in legislation which events were making more important and more exciting than any others in the politics of the time. Texas had just been annexed; the country was on the eve of a war of conquest with Mexico, and Great Britain was negotiating a fair settlement of the Oregon dispute. Should an expansion of national territory mean expansion of slavery,

and, if so, to what extent? were the questions now rising in angry debate. They were brought into Congress by the famous resolution called the "Wilmot proviso," which declared that no slaves should be held in any territory acquired as the result of the Mexican War. Extremists on the pro-slavery side set up the opposing doctrine that slave-holding was a constitutional right in any territory, since slaves were a species of property recognized by the Constitution of the United States. A second ground of opposition to the Wilmot proviso was discovered, apparently first by Gen. Cass, who contended that the inhabitants of each territory should admit or exclude slavery as they pleased, by their own votes. This doctrine of "popular sovereignty," or "squatter sovereignty," as it was branded scornfully by Calhoun, commended itself to Douglas' mind. His attitude toward slavery was that of indifference to the right or wrong of the system, which he regarded confessedly as a problem in politics, and no more. Practically, the "squatter sovereignty" doctrine triumphed in the compromise measures of 1850, which admitted California to the Union under the free-state constitution that her people had framed, and organized New Mexico and Utah as territories with no restriction concerning slavery. Excepting Henry Clay, no one did more than Douglas in the framing of those measures and carrying them through. He was now so conspicuous among the chiefs of the Democratic party that he could aspire to its nomination for President in 1852. From the North he received strong support; but the less known and more pliant Franklin Pierce was preferred at the South. Douglas, not yet forty years of age, could afford to wait. At some time within the next two years he conceived his project for a more complete and final settlement of the slavery question than the compromise of 1850 had brought about. This, in his view, could be accomplished by a frank and full adoption of the principle of "popular sovereignty," applied to the whole national domain. Accordingly, in 1854, he startled the country by reporting from his committee what was known in its final form as the Kansas-Nebraska Bill, repealing the Missouri Compromise of 1820 (which excluded slavery from the territory of the Louisiana Purchase, north of 36° 30') and leaving "the inhabitants thereof perfectly free to form and regulate their domestic institutions in their own way." At the North the bill raised a storm which even the bold spirit of Douglas must have watched with alarm. His own party was torn by it; that of the Whigs had already gone to pieces, and two new parties, "Know Nothing" or American, and Republican, now emerged from what seemed to be a general wreck of all in politics that belonged to the past. But Douglas, with no sign of faltering, fought a wonderful battle for his bill and carried it through. Then came the test in practice of his policy, applied in a struggle between anti-slavery and pro-slavery forces to control the settlement and the constitution-making of Kansas. The test was not favorable to the prestige of Douglas. He had heated instead of cooling the agitation of the slavery question, and made it more dangerous than before. As a candidate for the presidency he was hardly so strong in 1856 as in 1852; but after Buchanan, then elected, had driven Douglas to revolt, by countenancing the



fraud of the Lecompton Constitution, making a farce of "popular sovereignty" in Kansas, the manly course of the Illinois Senator gave him more of popularity in the free States than he lost in the South. The hostility of the administration, combining with the opposition of the new Republican party, already powerful in the Northwest, could not defeat his re-election to the Senate in 1858. Over any antagonist but Lincoln he would probably have won a great triumph; as it was, he came wounded from his debates with that extraordinary man. He had been forced to declarations that offended his party in one section of the country more than they satisfied it in the other, and made him the occasion of a hopeless breach between the two. Nominated, for President, at last, in 1860, by one wing of a divided party, he fought his last political battle, with all of his old obstinate valor, and went down in defeat. He was at the end of the small gift of bodily strength that he received at his birth; he had worn it out. He survived the election of Lincoln only long enough to stretch a loyal and supporting hand to his successful rival, in the crisis of rebellion that ensued. His last words to his followers were: "There can be no neutrals in this war."

J. N. LARNED,

*Author of the History for Ready Reference.*

**Douglas, Sir William Fettes**, Scottish painter: b. Edinburgh 29 March 1822; d. 20 July 1891. As a painter he was mainly self-taught. On first devoting himself to art he practised chiefly as a landscape painter, but he soon turned to figure subjects, producing 'Hudibras and Ralph visiting the Astrologer' (1856); 'Lovel and the Antiquary' (1857); 'The Summons to the Secret Tribunal' (1860); and 'The Magic Mirror' (1872); works distinguished by excellent coloring, and by especially firm, careful, and refined handling. His later years were entirely devoted to landscape water-colors. He is represented in the National Gallery of Scotland by 'The Messenger of Evil Tidings'; 'The Spell'; and 'The Bibliophilist.'

**Douglas, England**, capital of the Isle of Man, and a popular summer resort. Pop. 20,305.

**Douglas Fir**. See **FIR**.

**Douglass, Andrew Ellicott**, American archaeologist: b. West Point, N. Y., 18 Nov. 1819; d. New York 30 Sept. 1901. He was graduated at Kenyon College in 1838, and after a business career of many years with the Hazard Powder Company, of which he became the president in 1867, he retired in 1876, and spent 10 winters on the coast of Florida, excavating Indian mounds, and collecting specimens of archaeological interest to the number of 22,000, which may be seen in the American Museum of Natural History, New York. He is a member of many scientific societies, including the Société d'Anthropologie of Paris.

**Douglass, David Bates**, American civil and military engineer: b. Pompton, N. J., 21 March 1790; d. Geneva, N. Y., 9 Oct. 1849. He was graduated from Yale in 1813 and served in the engineer corps of 1813-31. He was one of the engineers of the Croton Aqueduct (1833-35), president of Kenyon College (1840-44), and professor of mathematics in Hobart College the last year of his life.

**Douglass, Frederick**, American lecturer and journalist, the son of a negro slave: b. Tuckahoe, Md., Feb. 1817; d. Washington, D. C., 20 Feb. 1895. Although his father was a white man, he was, according to the law, reared as a slave. In 1832 he was purchased by a Baltimore shipbuilder, but made his escape in 1838. As he had taught himself to read and write, and showed talent as an orator, he was employed by the Anti-Slavery Society as one of their lecturers. In 1845 he published his 'Autobiography,' and afterward made a successful lecturing tour in England. In 1870 he started a journal entitled 'The New National Era'; in 1871 he was appointed secretary of the commission to Santo Domingo; in 1872, presidential elector; in 1877, marshal for the District of Columbia, then commissioner of deeds for that district, and in 1889, United States minister to Haiti.

**Doukhobors**, доо'нѡ-бѡръ (Russian *dukhobortsy*, "spirit wrestlers," from their vanquishing the doctrine of the Holy Spirit), a sect which started in Kharkov, Russia, about 1740, and spread rapidly in the Dnieper provinces. The founder's name is not preserved: he was a Prussian sub-officer who settled in Russia when his term expired. He and his successors, Kolesnikoff, Kapustin, etc., taught the familiar doctrine of the "inner light," with logical but socially inconvenient extensions: that as God in the soul is the one guide to action, the Bible is not inspired (though they accept the Ten Commandments), and it is not only superfluous but sinful to read and write, printing being a snare of the Devil; that God manifests himself in the fullest power in the human soul, and as they had that power, they were embodiments of God, and to be worshipped and obeyed as such; that Christ was only a sinless man, and the sinless leaders were his equals and successors. Every one's action being dictated by God, it cannot be wrong, and civil rulers are needless and their rule a usurpation; all being equal before God, churches are needless and they do not enter them; marriages need neither ceremonies nor permission, being of inclination only. It is easy to see that these tenets brought them in conflict with the authorities, who tried to restrict them to theory instead of practice, and imprisoned numbers for contumacy; but in 1801 a commissioner's report to Alexander I. that they were well-behaved citizens induced him to order them left alone. It worked so ill, from insubordination and social evils, that in 1819 the same Czar again authorized the sharpest punishments. At length, on their petition for a grant of waste lands where they could live their chosen life undisturbed and undisturbed, they were settled on the fertile banks of the Molochnaya, on the north shore of the Sea of Azov. Thus left alone, the leaders and their satellites embarked on a carnival of lust, avarice, and despotism; no woman nor piece of property was safe from them, nor any man's life who protested (a minutely exact parallel to an American case in similar conditions), and bands of marauders went about stealing whatever their employers liked. The report of an imperial commission was so shocking that in 1833-7 they were deported to the then wilderness of Transcaucasia; a high bleak plateau unfit for agriculture, where they became almost wholly cattle-raisers and -eaters, and increased to some



## DOULTON—DOVE

15,000. The government gradually put down the civil despotism of the leaders, and enforced decency of life: but it was not done without much petty tyranny, and doubtless corruption and abuse, of which they complained. Then came Pobiedonostseff's policy of unifying the elements of the empire, and enforcing conformity to the Greek Church; and in 1887 a bitter faction fight between two pretenders to the Doukhobor leadership rent the community. One section decided to emigrate to be rid of it all; and finally obtaining permission and negotiating successfully with other governments, a few went to Cyprus, while in 1899 a band of 2,000, under a son of Count Tolstoi, settled on lands granted them in Manitoba. The next year 5,000 more were located there and in the Northwest Territories. They would not take lands in severalty, but only in communities; but they were prospering and learning English, filling the schools with their children, and appearing to slough off their unassimilable characteristics. Suddenly they adopted the tenet that all use of animals or their products for human service is sinful, and refused to eat milk, butter, or eggs, wear woolen or leather garments, or use draft animals. Then one settlement refused to pay school taxes, till the government seized and sold their cattle. In the summer of 1902 they all at once turned their stock loose on the prairies and began hauling their own loads to market, sometimes 50 miles off, and themselves drawing the plows; the government rounded up the stock, sold it, and placed the proceeds to the credit of the communities. While crippled in power to work for lack of animals, the rumor spread that Jesus was shortly to appear at Winnipeg, 300 miles east, to lead them to a new kingdom; they deserted the villages, and on the night of 27 Oct., 1,500 to 2,000 set off across country. After dreadful sufferings from cold and hunger, and joined by thousands more, men, women, and children, they came near Yorkton 10 days after, and lay out in the fields with the thermometer at 22°. The police singled out the women and children and the sick, and locked them into comfortable quarters: several hundred of the men went on alone, the women clamoring to accompany them and some going insane. When about 100 miles from Winnipeg, the mounted police forced them into freight cars and took them back to their villages. These antic seizures make it probable that the persecutions of the Russian government were not wholly without excuse or humane intent.

**Doulton, Sir Henry**, English potter: b. Lambeth 24 July 1820; d. 19 Nov. 1897. At 15 he entered his father's establishment there, where he devoted himself to the most technical branch of the industry, and worked for many years at the potter's wheel. In 1846 he commenced the manufacture of stoneware pipes for sewage and drainage, for which a special factory was erected near Lambeth Palace, and thus initiated the substitution of impervious pipes for the old flat-bottomed brick drains. Sir Henry Doulton, however, is chiefly noteworthy as having been mainly instrumental in bringing about the revival in art pottery which has since spread into every civilized country; and his firm's works in art stoneware, silicon, impasto, terracotta, faience, and Doulton wares, have since 1870 gained the highest awards of judges at every exhibition of note throughout the world.

He was created a Chevalier of the Legion of Honor (1878); was awarded the Albert medal in 1885; and in 1887 was knighted on the occasion of the queen's jubilee. See POTTERY.

**Doune**, Scotland, village of Perthshire, on the Teith, nine miles from Stirling. Doune Castle, now a ruin, is described in Scott's 'Waverley'. Pop. 1,200. At Deanston, a mile west, are large cotton-mills, long managed by James Smith, a noted inventor and philanthropist.

**Douro**, dô'roo, or **Duero**, doo-a'rô (ancient *Durius*), one of the largest rivers of the Spanish Peninsula, which, flowing west, traverses about one half of Spain and the whole of Portugal, and, after a course of 500 miles, flows into the Atlantic three miles below Oporto. It is not of much navigable importance, but small vessels ascend about 70 miles from its mouth. In the Middle Ages it was celebrated for the gold that was found in its bed.

**Douroucoulî**, doo-roo-koo'lê, a small Brazilian monkey, of nocturnal habits, which sleeps by day, and preys fiercely by night upon insects and small birds. It is of the genus *Nyctipithecus*, of which various species are known, all South American. They are about nine inches long, with tails somewhat longer than their bodies; and have soft grayish fur; their voices are discordant and disagreeable. They are known also as "owl-monkeys," and "night-monkeys."

**Dousa, Janus** (Latinized from JAN VAN DER DOES), Dutch statesman, philologist, historian, and poet: b. Noordwyk, Holland, 6 Dec. 1545; d. there October 1604. In 1572 he went as ambassador to England to obtain the support of Queen Elizabeth for the cause of the Dutch. As chief commander, during the siege of Leyden by the Spaniards, he conducted himself with prudence and courage in the midst of the horrors of famine, plague, and civil dissensions. He kept up an intercourse with the expected deliverers by means of trained pigeons; and to these faithful messengers he has expressed his gratitude in some of his poems. The stadtholder, William I., compensated the city for its sufferings by the establishment of the university, of which Dousa was the first curator. His best-known work is 'Bataviæ Hollandiæque Annales' (1599).

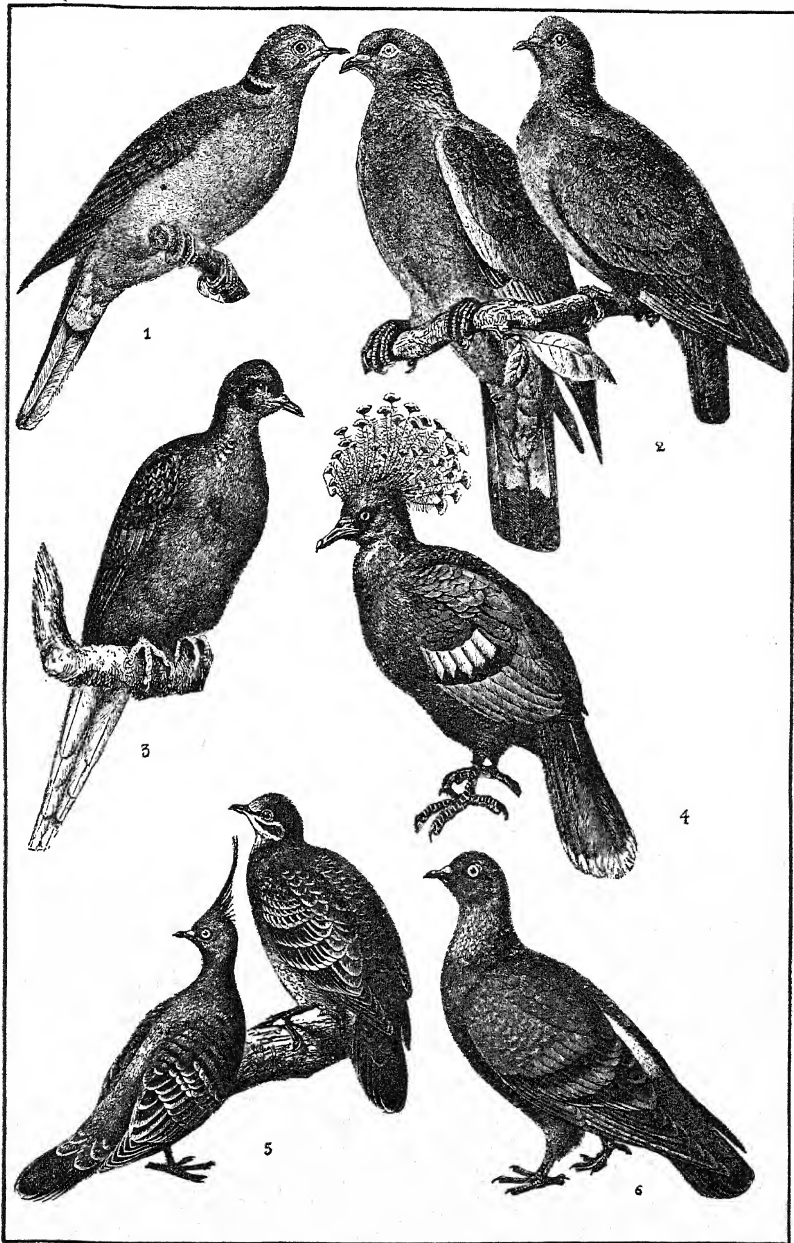
**Douw, Gerard**. See DOW, GERARD.

**Douzzette**, dow'zët, **Louis**, German painter: b. Triebsees, Pomerania, 25 Sept. 1834. He received a gold medal at Berlin in 1886. He is a landscape painter almost exclusively, and is particularly noted for his moonlight effects. His 'Moonlight on the Fjord' is in the Dresden gallery.

**Dovalle, Charles**, shârl dô-vâl, French poet: b. Montreuil-Bellay 23 June 1807; d. 30 Nov. 1829. He was a poor provincial who came to Paris unknown, studied law, and burst on the literary world with 'The Oratory in the Garden,' and other delightful poems of a like nature, besides an 'Ode on Liberty.' His promising career was closed at 22 in a duel, the challenger being enraged at a literary criticism.

**Dove, Heinrich Wilhelm**, hîn'rih vîl'hêlm dô'vê, German physicist and meteorologist: b. Liegnitz 6 Oct. 1803; d. Berlin 4 April 1879.

# REPRESENTATIVE DOVES.



1. Domestic Turtle-dove (*Turtur risorius*).
2. European Wood-pigeon (*Columba palumbus*) at the left; and Stock-dove (*C. xenas*) at the right.
3. American Wild or Passenger Pigeon (*Ectopistes migratorius*).

4. Papuan Crowned Pigeon (*Coura albertisi*).
5. Crested and Common Australian Bronze-winged Doves.
6. Blue Rock-dove (*Columbia livia*).



He was educated at Breslau and Berlin, and in 1845 he was appointed professor of natural philosophy at the university of the latter city, a post which he held till his death. Among his works are 'Meteorological Researches' (1837); 'Distribution of Heat on the Surface of the Globe' (1852); 'Law of Storms' (1857); 'Optical Studies' (1859), and many papers in various journals.

**Dove, Patrick Edward**, Scottish economist: b. Lasswade 1812; d. Cape Town, Cape Colony, 1870. He was graduated at Aberdeen and studied at Heidelberg, achieving fame with 'The Theory of Human Progression' (1850), from which Henry George was accused of stealing the "single tax" idea. Dove wrote also: 'Science of Politics.'

**Dove**, a river in England, a tributary of the Trent, has its rise in the hills of the Peak of Derbyshire. It was the favorite fishing stream of Izaak Walton, who lived near with his friend, Charles Cotton; and it is still beloved of anglers.

**Dove**, originally applied in England to several native and domesticated species of the genus *Columba*; the name dove is now used generally for the smaller species of the pigeon family (*Columbidae*, q.v.), but in many cases interchangeably with pigeon. The name applies to about 10 native North American species, of which the most important are the mourning dove (*Zenaidura macroura*); the white-winged dove (*Melopelia leucoptera*); the ground dove (*Columbigallina passerina*), and several species of ground dove, of which only the first extends its range northward, the others being more especially derived from the West Indian and Mexican fauna, which includes many additional species. The mourning dove, so-called on account of its plaintive call, and unadorned plumage, ranges and breeds throughout temperate North America. The nest is a loose structure of twigs in which two eggs are deposited. In the late summer and autumn, when congregated in small flocks, doves are sometimes destructive to crops, and are much sought by gunners in localities where the game laws permit.

Several species of European and other exotic doves are well-known in this country in the domesticated state. The ring dove (*Columba palumbus*) occurs throughout Europe, collecting in large flocks during the winter and depredating fields of turnips and other crops. The rock dove, or rock pigeon (*C. livia*), is considered by Darwin ('Animals and Plants Under Domestication') to have been the original stock of our domesticated pigeons, which, as a result of careful selection, have diverged into many races, arranged by Darwin in four principal groups: (1) Pouters; (2) Carriers, Runts, and Barbs; (3) Fantails, Tumblers, Turbits, etc.; and (4) Trumpeters—which lead through some little modified varieties to the original stock still existing on the coasts of Europe and North Africa.

The turtle dove (*Turtur communis*), of Europe has been universally adopted in Christian countries as the emblem of gentleness and love, and figures much in poetry. The dove was the bird of Venus. Babylon was the city of the dove; it was a dove that whispered into the ear of Mohammed, and was his oracle. The dove was a sacred bird to the Israelites, and Jerusa-

lem was the city of the dove. In Christian times it was the attribute of the Virgin Mary; was a symbol of the Holy Ghost, and carved on the tombs of martyrs as a figure of the resurrection.

**Dove, The**, one of two vessels which in 1633 sailed from Cowes, England, for Maryland with a company of colonists under Leonard Calvert. The other vessel was named The Ark. After a four months' voyage they landed on St. Clement's Island in the Potomac River.

**Dove-plant**, or **Holy Ghost Plant**, an orchid of Central America, much revered by the pious natives because of its resemblance to a dove with outstretched wings, the symbol of the Holy Ghost; called also Holy-Spirit flower.

**Dove-tick**, a bird parasite (*Argas reflexus*), the blind tick which infests doves and other birds. Some of the species are said to cause death by their sting. See **TICK**.

**Dovekie**, düv'kî, the little auk (*Alle alle*), one of the smallest of the family *Alcidae*, a bird of high northern latitudes, living and breeding gregariously, on rocky sea-coasts of the North Atlantic and Arctic oceans. A single egg is laid by this bird on the bare rock. In winter, it is found along the coast of New England and the Middle States, and is occasionally blown by storms as far inland as Michigan. The dovekie, or sea dove, as it is also sometimes designated, is from eight to nine inches long; of a glossy blue-black above, with the under parts, and two patches on each wing, white. The adults have a small crest on the base of the beak.

The name is also sometimes applied by fishermen to one or more species of guillemot (q.v.).

**Do'ver**, Del., city, capital of the State and county-seat of Kent County; on Jones creek, and the Philadelphia, W. & B. R.R., 75 miles south of Philadelphia. It is the seat of Wilmington Conference Academy and has a handsome monument erected to the memory of Cæsar Rodney, one of the signers of the Declaration of Independence. It is the centre of a great fruit-growing region. It is on high ground; is laid out with wide, straight streets that cross each other at right angles; and is built up chiefly with brick. Among its noteworthy buildings are a handsome State house, large courthouse, and new United States government building. Connected with the State house is a State library with upward of 50,000 volumes. There are several churches, a national and a State bank, fruit evaporating and packing establishments, steam flour-mill, foundry, machine shop, and sash, fruit crate, glass, and carriage factories. The city has valuable gas and water works, weekly newspapers, and good schools. Pop. 3,329.

**Dover**, England, a Cinque port and parliamentary and municipal borough in the east of Kent, England, 66 miles east-southeast of London. It is the headquarters of the South-eastern District of the British Army, and the nearest point of the English coast to France. The fortifications comprise Dover Castle, which occupies a commanding position on the chalk cliffs, 375 feet above the level of the sea, and still includes some of the old Saxon and Norman work; Fort Burgoyne on the north side of the town; Archcliffe Fort to the west, and the

## DOVER—DOW

batteries on the Western Heights, where large barracks are situated. Pop. 35,000.

**Dover, N. H.**, city, county-seat of Strafford County; on Cocheco River, and the Boston & M. R.R.; 168 miles north-northeast of Boston. It is situated on hilly ground, is regularly laid out, and has many handsome buildings and residences. The Falls of Cocheco, within the city limits, are the source of abundant water power. Dover's industries include several large cotton- and woolen-mills; an extensive print works, with a capacity of over 30,000,000 yards annually; manufactories of boots and shoes, oil cloth, hats and caps, sandpaper and glue; and several tanneries, brass- and iron-foundries, and machine shops. There are several churches; about 40 public schools, high school, St. Joseph's Hill School, Franklin Academy; a national bank; several savings banks; daily and weekly newspapers; electric lights, and street railways. It is the oldest city in the State; was settled in 1623; nearly destroyed by the Indians in 1689; and was chartered as a city in 1855. Pop. (1900) 13,207.

**Dover, N. J.**, city in Morris County, on the Rockaway River, the Lackawanna, and the New Jersey C. R.R.'s, and the Morris and Essex Canal; 28 miles west of Newark. It has extensive iron interests, railroad shops, machine shops, furnace and stove factories, and silk and hosiery mills. Five miles distant is a government powder magazine. Nearby are Lake Hopatcong, Mt. Arlington, Budd's Lake, and Schooley's Mountain, all noted summer resorts. The city has a high school, several churches, business college, daily and weekly newspapers, electric lights, and a national bank. Pop. 6,000.

**Dover, Tenn.**, town, county-seat of Stewart County; on the Cumberland River, near Fort Donelson (q.v.). It is an insignificant village of less than 500 inhabitants, but is noteworthy as containing a national cemetery, where 672 soldiers of the Civil War are buried.

**Dover, Strait of**, the narrow channel which connects the North Sea with the English Channel, and separates England and France. At the narrowest part it is only 21 miles wide. The depth of the channel at a medium in the highest spring tides is about 180 feet. On both the French and English sides the chalky cliffs show a correspondence of strata which leaves no room for doubt that they were once united. Various projects for connecting Dover and Calais more closely have been advanced, as by bridge or tunnel or by trains on submerged rails. When making examinations for the tunnel scheme, coal was discovered in the bed of the Strait.

**Dover's Powder** was first prescribed by Thomas Dover, M.D. (1660-1742). The powder is prepared by mixing powdered ipecacuanha root, 1 part; powdered opium, 1 part; and sulphate of potash, 8 parts. The whole is thoroughly mixed, and the ordinary dose is from 5 to 10 grains. Occasionally, saltpetre is added. It is a most valuable medicine, and acts as a sudorific, increasing the proportion of sweat or sensible perspiration. As a "home remedy" for warding off a cold it is considered invaluable. Three or four grains will often relieve an attack of heartburn.

**Dovetail**, a term used in carpentry; the fastening of boards together by letting one piece into another, in the form of the tail of a dove. The dovetail is the strongest of jointings, because the tenon, or piece of wood which is put into the other, goes widening to the end, so that it cannot be drawn out again. Dovetails are either exposed or concealed; the latter being of two kinds, lapped and mitred. There is also a dovetail hinge, dovetail saw, dovetail file and in Roman architecture an ornamented molding in the form of a dove's tail.

**Doveton, Frederick Bazett**, English author: b. Exeter 1841. He has published 'Snatches of Song' (1880); 'Sketches in Prose and Verse' (1886); 'Maggie on Mythica: a Fairy Tale' (1890); 'Songs Grave and Gay' (1893); 'A Fisherman's Fancies' (1895); 'Mirth and Music' (1901).

**Dovizio, Bernardo**, bër-nâr'dô dô-vě'tsě-ô. See BIBBIENA.

**Dovre-fjeld**, dôv-rě-fyål', or **Doerines**, an assemblage of mountain masses, Norway, forming the central part of the Scandinavian system, and extending east-northeast from lat. 62° N., where the Langfield terminates, to lat. 63°, where the Koelen begins. It is generally composed of gneiss and mica-schist, and its highest summit is Snehaetten, 7,620 feet.

**Dow, or Douw, Gerard**, Dutch painter: b. Leyden 7 April 1613; d. there Feb. 1675. He studied under Rembrandt, and was distinguished for the excellence of his coloring and *chiaroscuro*. He surpassed his master in diligence, and nothing can be more finished than his small pieces, which are so delicate that a magnifying-glass is necessary to see distinctly the work in them. His softest figures are full of life, and he never neglected, in his representations, the almost invisible minutiae of nature. He is regarded as the inventor of the ingenious mode of painting large pictures on a reduced scale, by covering the original with a frame, including a space divided into small quadrangular parts by means of threads, and then transferring the parts into an equal number of similar divisions, drawn on the canvas. He made use of the convex mirror to represent objects on a reduced scale. His works are still among the dearest of the Dutch school. His picture of 'The Fish Merchant' when sold in 1883 brought about \$10,000.

**Dow, Lorenzo**, American preacher: b. Coventry, Conn., 16 Oct. 1777; d. Georgetown, D. C., 2 Feb. 1834. Adopting the doctrines of the Methodists, 1796, he finally received a regular license to preach, and, in spite of contumely and rebuffs, and ceaseless hardships and dangers of all kinds, persevered for nearly 40 years, with an enthusiasm which never relaxed, and often with astonishing effect. In the course of his ministry he traveled over many parts of the United States and Canada, and in 1799 and again in 1805 visited England and Ireland, where his peculiar eloquence attracted much attention and on several occasions subjected him to persecution. Dow's eccentricity of manner and dress for a long time excited a prejudice against him, and in many parts of the country he was familiarly known as "crazy Dow." But to the class whom he most frequently addressed, his simple fervor, though coupled with illiterate phrase-

## DOW—DOWLER

ology, supplied the place of eloquence, and he seldom failed of having attentive and even enthusiastic hearers. His journal, containing the history of his life to his 40th year, together with some of his miscellaneous writings, was published in 1856.

**Dow, Neal**, American temperance reformer: b. Portland, Me., 20 March, 1804; d. 2 Oct. 1897. He was the author of the bill which prohibited the manufacture and sale of intoxicating liquors in the State of Maine, widely known as the "Maine Law." During the Civil War he was colonel of a Maine regiment and a brigadier-general of volunteers. In 1880 he was the Prohibitionist candidate for the Presidency.

**Dowd, Charles Ferdinand**, American educator: b. Madison, Conn., 25 April, 1825. He was graduated at Yale in 1853, and for many years he has been principal of Temple Grove Seminary at Saratoga. He originated the idea of longitude standards for railroad time, and advocated the 24-hour time notation.

**Dowden, Edward**, English literary critic and historian: b. Cork, Ireland, 3 May, 1843. He was educated at Queen's College, Cork, and Trinity College, Dublin, and 1867 was elected to the professorship of English Literature in the latter institution, a post he still holds. Besides many valuable articles in periodicals he has published many works on literary subjects, of which the most important are 'Shakspeare: His Mind and Art' (1875); 'Poems' (1876); 'Shakspeare Primer' (1877); 'Studies in Literature' (1878); 'Southey' (1880); 'Life of Shelley' (1886), the chief authority on the poet's life, being founded on papers in the possession of the Shelley family; 'Transcripts and Studies' (1888); 'Introduction to Shakspeare' (1893); 'New Studies in Literature' (1895); 'The French Revolution and English Literature' (1897); 'History of French Literature' (1897); 'Puritan and Anglican' (1900). He has also edited editions of Shelley, Wordsworth, etc. In 1896 he lectured in the United States.

**Dowden, John**, Scottish prelate: b. Cork, Ireland, 29 June 1840. He is a brother of E. Dowden (q.v.). He was educated at Queen's College, Cork, and Trinity College, Dublin, and taking orders in the Scottish Episcopal Church became Bishop of Edinburgh in 1886. He has published 'The Annotated Scottish Communion Office'; 'The Celtic Church in Scotland'; 'History of the Theological Literature of the Church of England'; 'The Workmanship of the Prayer Book.'

**Dower**, the estate for life which a widow acquires in a certain portion of her husband's real property after his death. Dower, by the common law of the United States, entitles the widow to a third part of all the lands and tenements of which the husband was seized in fee simple, at any time during the coverture; but the rule varies widely on many particulars in the different States. Tenancy in dower is where a widow takes a third of such lands and tenements of which her husband dies possessed, and in which her title to dower has not been previously barred. Some have ascribed dower to the Normans, but it was first introduced into the feudal system by the German Emperor Frederick II., who was contemporary with

Henry III. of England. The person endowed must be the actual wife of the party at the time of his decease. If she be divorced *a vinculo* she shall not be endowed; but a judicial separation does not destroy the dower.

**Dowie, John Alexander**, American leader of a religious sect: b. Edinburgh, Scotland, 1847. He studied for the ministry, and held two pastorates in Sidney, Australia, but subsequently became an evangelist preacher. While in Australia he organized the International Divine Healing Association of which he became president. In behalf of this association he traveled in England and America, and finally settled in Chicago in 1890. Here he built his wooden "tabernacle" in Woodlawn, which was opened in 1893, and attracted large crowds by his preaching and faith cures. He later organized the Christian Catholic Church in Zion, which grew rapidly, adding many auxiliary lines of work, such as a college for Zion preachers, a training school for deaconesses, and a number of charitable institutions. Dowie had already established a publishing house, which became a part of the organization, and had full control of a bank, known as the Zion bank. He finally organized a land association, and purchased a large tract of land on the shores of Lake Michigan, where he and his devotees are building Zion City, the centre of all the numerous activities of the Christian Catholic Church; here he has also established a lace industry. In this city he is practically dictator, forbids smoking, drinking, card playing, etc., and oversees all branches of the work. He also preaches frequently, and gives special attention to the healing of the sick. In 1901 he made the claim of being "Elijah the Restorer." In 1903 he built the new tabernacle at Zion City, near Chicago, Ill., which he claims is the largest building in the United States devoted exclusively to the worship of God.

Consult Buckley, 'Dowie Analyzed and Classified' ('Century Magazine,' Vol. LXIV., pages 928-32); Napes, 'John Alexander Dowie and his Zions'; ('Independent,' Vol. LIII. p. 1786-91); Swain, 'John Alexander Dowie' ('Century Magazine,' Vol. LXIV. p. 933-44).

**Dowitcher**, dow'ich-ér, a sporting name for birds of the genus *Macrorhamphus*, which are related to the snipes, and are much hunted along the beaches of this country, during the season. Two species, breeding far north, winter in South America and Mexico. The birds are from 10 to 12 inches long, with a bill nearly one fourth the length of the body. The upper parts are dark, while the under feathers are reddish.

**Dow'las**, a kind of coarse linen, very commonly worn by the lower classes in the 16th century; also a strong calico made in imitation of the linen fabric. The name is said to be derived from Doullens, a town in the department of Somme, France. Before the introduction of machine-woven cotton cloth, dowlas was manufactured largely in Yorkshire, England, and in the south of Scotland.

**Dowler, Bennett**, American physician: b. Moundsville, Va., 16 April 1797; d. New Orleans 1879. He graduated from the University of Maryland, and settling in New Orleans founded the New Orleans Academy of Sciences, and was for a number of years editor of the



## DOWLETABAD — DOYEN

‘Medical and Surgical Journal.’ He made a number of experiments with the human body immediately after death, resulting in important discoveries in regard to capillary circulation, contractibility, etc., and also investigated the subject of animal heat. He wrote ‘Tableau of the Yellow Fever of 1853’ (1854).

**Dowletabad**, dow-lē-tā-bād’, or **Daulatabad**, India, one of the most remarkable fortresses of India, in the Nizam’s Dominions (Haidarabad), 10 miles northwest of Aurangabad. The strong part of it consists of an isolated rock or mass of granite, 500 or 600 feet high, and forming, for about 150 feet, a mural precipice. The only access to the small platform on the summit, is through a low excavation in the heart of the rock. There is a ditch and other works round the base of the rock.

**Down**, county of Ireland, in the province of Ulster; area 610,730 acres. It possesses good agricultural land, and is rich in minerals. Pop. 289,335.

**Downes, William Howe**, American journalist art critic: b. Danbury, Conn., 1 March 1854. He has been a staff writer on the Boston *Transcript* for many years. He has published ‘Spanish Ways and By-ways’; ‘The Tin Army of the Potomac’; ‘Arcadian Days’; ‘Twelve Great Artists’; and written many papers on art matters for various magazines.

**Downfall, The** (‘LA DÉBÂCLE’), a novel of the Franco-Prussian war, by Émile Zola, published in 1892. The siege of Sedan forms the dramatic centre of the story, which is concerned chiefly with the friendship of Macquart and Levasseur, and the love of Macquart and Levasseur’s sister Henriette.

**Downing, Andrew Jackson**, American landscape gardener: b. Newburg, N. Y., 20 Oct. 1815; d. near Yonkers, N. Y., 28 July 1852. His ‘Landscape Gardening and Rural Architecture’ (1841); ‘Cottage Residences’ (1842); ‘Fruits and Fruit Trees of America’ (1845); were long considered authorities on the subjects of which they treat.

**Downing, Charles**, American horticulturist: b. Newburg, N. Y., 9 July 1802; d. there 18 Jan. 1885. In 1837 he established a nursery near the city of Newburg, and remained in the business for 30 years. His experiments resulted in the improvement of many varieties of fruit, and he was regarded as an authority on horticulture and fruit growing. In the later years of his life he contributed articles to various periodicals, and revised and greatly enlarged ‘Fruits and Fruit Trees of America,’ written by his brother, A. J. Downing (q.v.).

**Downing, Fanny Murdaugh**, American author: b. Portsmouth, Va., about 1835; d. 1894. She was the author of the novels ‘Nameless’ (1865), and ‘Perfect through Suffering’; and the poems ‘The Legend of Catawba’ and ‘Dixie’ (1867).

**Downing, R. F.**, American customs broker and shipper: b. New York 5 May 1849; d. Brooklyn, N. Y., 30 April 1903. He founded the brokerage and shipping firm of R. F. Downing & Co. and with each alteration in the tariff law published the work known as ‘Downing’s Customs Tariff.’

**Downing College**, one of the colleges of the University of Cambridge, chartered in 1800

and opened in 1821. Its founder was Sir George Downing, a Cambridgeshire gentleman, grandson of the politician after whom Downing Street in London was named. The objects of the founder were but partially realized, as his legacy was wasted in costly litigation, and in 1903 less than one half of the contemplated quadrangle was completed and there were but few fellows and students.

**Downing Street**, a short street in Whitehall (named after Sir George Downing (q.v.), secretary to the treasury in 1667), London, England, where are the colonial and foreign offices, with the official residence since 1735 of the first lord of the treasury. Here cabinet councils are held, hence the term is sometimes employed for the government in office.

**Downs**, hilly tracts of grassy land suited for pasture; especially two parallel ranges of grassy hills in the south of England, the North Downs running east to west from Hants through Surrey and Kent to Dover, the South Downs in Hants and Sussex, terminating at Beachy Head.

**Downs, The**, a celebrated roadstead for ships, extending six miles along the southeast coast of Kent, in England, between the North and the South Foreland, where outward and homeward bound ships frequently make some stay, and men-of-war often rendezvous in time of war. It affords excellent anchorage, and is sheltered by Goodwin Sands, but is open to the south. Deal, Dover and Sandown castles are its defense. An obstinate sea-fight took place here in 1666 between the English and Dutch.

**Doxology**, an ascription of praise to the Almighty: in particular the Greater Doxology (*Gloria in excelsis*, Glory to God in the highest) and the Lesser Doxology (*Gloria Patri et Filio*, etc., Glory be to the Father and the Son; etc.) The Greater Doxology, as is seen, opens with the words of the evangelist St. Luke when he recounts the circumstances attending the birth of Jesus at Bethlehem; the heavenly host chanting Glory to God in the highest, and on earth peace among men of good will. This Greater Doxology has a place in the Roman Catholic liturgy and in the communion service of the Anglican Church. Its introduction into the liturgy dates only from the time of Pope Symmachus (beginning of 6th century); previously it had been customary to recite it after the Mass. The Lesser Doxology had its origin apparently in the commission given to the Apostles (Matt. xxviii. 19) to teach all nations, baptizing them ‘in the name of the Father, Son, and Holy Spirit.’ An ancient form of this Doxology is ‘Glory to the Father in the Son,’ and that was considered to be consistent with orthodoxy till the Arians favored it as expressing their view of the relation of Jesus Christ to God the Father: then the orthodox rejected it and employed the other formula exclusively. In the Roman Catholic Breviary at the end of each of the psalms of the daily office the *Gloria Patri*, etc., is always pronounced. The latter portion of this doxology, ‘as it was in the beginning, is now, and ever shall be. Amen,’ was appended as a protest against certain heretics of the 6th century who denied the Son’s eternity.

**Doyen, Gabriel François**, gäb-rē-ël frän-swä dwä-yän, French painter: b. Paris 1726; d. St. Petersburg 5 June 1806. After study with Van Loo, he obtained the Grand Prix de

Rome, and spent many years in Italy. His 'Triumph of Amphitrite' is in the Louvre, and an 'Adoration of the Magi' in the museum at Darmstadt. Other noted productions are in various churches, his most famous production, 'Miracle des Ardes,' painted in 1767, being in that of St. Roch, Paris.

**Doyle, Sir Arthur Conan,** English novelist: b. Edinburgh, Scotland, 22 May 1859. He is a nephew of Richard Doyle (q.v.). He was educated at the Roman Catholic college at Stonyhurst, Lancashire, and at the University of Edinburgh. After practising as a physician at Southsea (1882-90), the success of several of his books induced him to give up the profession for that of literature. He has published 'A Study in Scarlet' (1887); 'The Captain of the Polestar' (1888); 'Micah Clarke' (1888); 'The Sign of the Four' (1889); 'The White Company' (1890); 'The Firm of Girdlestone' (1890); 'The Adventures of Sherlock Holmes' (1891); a very popular series of detective stories; 'The Refugees' (1891); 'The Great Shadow' (1892); 'Memoirs of Sherlock Holmes' (1893); 'Round the Red Lamp' (1894); 'The Stark Munro Letters' (1895); 'Exploits of Brigadier Gerard' (1896); 'Rodney Stone' (1896); 'Uncle Bernac' (1897); 'The Tragedy of the Korosko' (1898); 'Songs of Action' (1898); 'A Duet with an Occasional Chorus' (1899); 'The Green Flag and Other Stories' (1900); 'The Great Boer War' (1900); 'Cause and Conduct of the War'; 'The Hound of the Baskervilles' (1902). He has also written the plays, 'A Story of Waterloo' (1894); 'Halves' (1899), etc. He was knighted in 1902.

**Doyle, C. W.,** American physician and author: b. Landour, India, 29 Aug. 1852; d. Santa Cruz, Cal., 1903. He was educated at Calcutta University, studying medicine in London, Edinburgh and Aberdeen. He was graduated from the latter in 1875, and practised in England till 1888, when he went to California to live, continuing his practice there. He has published much verse and prose in the magazines, and the volumes 'The Taming of the Jungle' (1889); 'The Shadow of Quong Lung' (1899).

**Doyle, Sir Francis Hastings Charles,** English poet: b. Nunappleton 1810; d. 8 June 1888. He was educated at Eton and Oxford, held the post of receiver-general and next of commissioner of customs, and in 1867 he was elected to the chair of poetry in Oxford University for the term of five years, being then elected for a second term of the same duration. He had already published 'Miscellaneous Verses' (1841); 'Two Destinies' (1844); 'The Return of the Guards and other Poems' (1866); and he subsequently published his Oxford lectures (1869 and 1877), and 'Reminiscences and Opinions 1813-85' (1886).

**Doyle, John,** English caricature artist: b. Dublin 1797; d. 2 Jan. 1868. After studying art in his native city he went to London in 1821, and produced a series of caricatures which became famous as the "H. B." caricatures from the initials attached to them, the identity of the artist remaining unknown. From 1829 to 1851 all the politicians of note were in this way gently and cleverly satirized, always within the limits of good taste and gentlemanly feeling. These works, which were executed by means of lithography, appeared in sets of four or five at a

time, and ultimately the plates amounted to over 900 in number.

**Doyle, John Andrew,** English historian: b. 14 May 1844. He was educated at Eton and Balliol College, Oxford. He has published 'The American Colonies' (1869); 'A History of the United States' (1875); 'The English in America,' Vol. I.; 'Virginia, Maryland and the Carolinas' (1882), Vol. II.; 'The Puritan Colonies' (1887).

**Doyle, Richard,** English artist: b. London Sept. 1826; d. there 11 Dec. 1883. His father, John Doyle (q.v.), the author of the celebrated "H. B." caricatures, initiated him into the mysteries of his art, and the young draughtsman became one of the founder-illustrators of "Punch," the current design on the cover of which was invented by him. His sketches of the 'Manners and Customs of ye English' in that periodical, and the 'Bird's-eye Views of Society' in the early pages of the 'Cornhill Magazine,' illustrate the mode of life and manners of London men and women of his time with rare felicity and fidelity. In 1850 he severed his connection with 'Punch' on account of its frequent attacks on the Pope and Doyle's co-religionists, the Roman Catholics. From that time he contributed many illustrations to books. His watercolor pictures of fairy lore are well known.

**Doylestown, Pa.,** town, county-seat of Bucks County, about 25 miles in an air line from Philadelphia. It is the terminus of a branch of the Philadelphia & R. R.R. The town is thriving and has a number of fine public buildings. Its chief manufactures are, agriculture and wagon spoke works, flour and saw-mills, creameries, clay works, and a foundry. Pop. (1900) 3,034.

**Dozy, Reinhart, rin'härt dō'zē,** Dutch Orientalist and historian: b. Leyden 21 Feb. 1820; d. 29 April 1883. He was thoroughly versed in most of the Semitic tongues, and spoke and wrote almost all the European languages with facility. Among his works, (sometimes written in Dutch, and sometimes in French) are 'Histoire des Musulmans d'Espagne de 711-1110'; 'Géographie d'Edrisi'; 'De Israeliten te Mekka' (1864); 'Het Islamisme' (1863); 'Supplements aux Dictionnaires Arabes' (1878-89).

**Draa, drā, or Wady Draa,** a river of Morocco, rising in the Atlas Mountains and flowing southwards till it penetrates the Anti-Atlas at Shagerun. Beyond this point it flows sluggishly through the desert, at first south and then west, forming the shallow lagoon El Debaia. After this it is a wady constituting the southern limit of Morocco.

**Dracæna, dra sē'na,** a genus of tropical plants of the natural order *Liliaceæ*. The species are characterized by woody stems, which bear numerous sword-shaped leaves crowded together near the summit, and greenish-white or yellowish flowers, in panicles or heads. A few of the species are cultivated in hothouses, for their attractive colored foliage. The most notable species is, probably *D. draco*, the dragon-tree of the Canary Islands, which attains a height of from 30 to 50 feet, though in one notable specimen, at Teneriffe, the height was 70 feet, and the diameter 15 feet. This was when Humboldt visited the island. When this tree was

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destroyed by a storm in 1868 it was estimated to be about 6,000 years old. It was not only an object of worship, but its sanctuary was inside its own trunk.

**Drachenfels**, drā'hēn fēlz, "the castled crag of Drachenfels," as Byron calls it, one of the hills known as the Siebengebirge, in the government of Cologne, in Rhenish Prussia, about eight miles southeast of Bonn. It is the most remarkable of the group, which are all evidently volcanic; rises about 900 feet above the Rhine, and is crowned by the old castle of Drachenfels, commanding a magnificent view. It takes its name (Dragon Rock) from the legend of a dragon which occupied a cavern in it, and was slain by Siegfried, the hero of the Nibelungenlied.

**Drachma**, drāk'mā, the unit of weight and of money among the ancient Greeks, both as a weight and a coin contained six oboli, and was itself the one hundredth part of a mina, and the six thousandth part of a talent. The weight of the Attic drachma was 67.5 grains English troy weight, and the Attic talent 70.3 pounds. There were several other kinds of drachma and talent in use: those of Ægina were the heaviest. Whenever no particular kind is designated, the Attic talent is meant. The drachma was the principal Greek coin. It was of silver, and was divided, like the weight, into six oboli (silver). The tetradrachma (of four drachmas) was called the *stater*, but other coins also bore this name. These coins differed much in value in the different states of Greece and at different periods. The Attic drachma and stater occur most frequently. The value of the former may be stated as 17 cents, of the latter at about 80 cents. The drachma was regarded as equivalent to the Roman denarius. Besides these silver coins there were also the stater (or didrachm) of gold, equal in value to about \$5.63. In the time of Solon a sheep could be bought for one drachma, an ox for five. In the time of Demosthenes a fat ox cost 80 drachmas, a lamb 10. The drachma has an important position in the coinage and currency of modern Greece, being the standard unit of reckoning, and a silver coin equivalent to the French franc.

**Drach'man**, Bernard, American rabbi: b. New York 27 June 1861. He was educated at Columbia University and the University of Breslau and has been professor of biblical exegesis and Hebrew philosophy in the Jewish Theological Seminary of New York from 1887, and rabbi of the congregation Zichon Ephraim in that city from 1889. He is a staunch supporter of orthodox Judaism and is the author of 'The Place and Importance of Jehuda Hajjug in the History of Hebrew Grammar' (1885).

**Drachmann**, Holger Henrik Herholdt, hōl'gēr hēn'rik hēr'hōlt drān'mān, Danish poet, painter, and novelist: b. Copenhagen 9 Oct. 1846. He is essentially an improvisatore; and his works show a lively fancy and excel in descriptions of the life of the common people, especially fishermen and mariners. His 'Poems' appeared in 1872. His novels include 'Condemned' (1890); 'Once Upon a Time'; 'Paul and Virginia' (1879); and 'Sea Tales.' His best known painting is 'From Hamburg Harbor,' presented by the Danes in Hamburg to the king and queen of Denmark a few years ago. Drachmann visited the United States in 1898.

**Draco**, drā'kō, Athenian legislator: fl. about 621 B.C. His name has become proverbial for severity, and his laws were hence said to have been written in blood, not ink. It seems, however, probable that Draco only put in writing the laws of his time and nation, which punished petty theft, and even idleness, no less severely than the robber of the temples and the murderer. Subsequently years afterwards, Solon was commissioned to draw up a new code. Tradition relates that Draco, on his appearance in the theatre at Ægina, was suffocated by an enthusiastic audience, who, according to their custom, threw their garments and caps upon him.

**Draco**, an ancient northern constellation. The star Draconis, a bright star nearly in the solstitial colure, was used in determining the coefficient of aberration of the fixed stars.

**Dracoceph'alum**, a genus of odoriferous annual or perennial herbs, of the mint family (*Labiata*), numbering about 35 species, natives of the northern hemisphere. The name is Greek for Dragonhead, which is a reference to the resemblance of the flowers to the head of the dragons of myth. Of the species comprised in the genus, but two are American. American Dragonhead (*D. parviflorum*) is an annual, two to six feet high with light blue flowers, common in stony soil from Ontario, through northern New York, to Minnesota and Alaska, and in the Rocky Mountain region to Mexico. The other species is found only in a restricted area in Nebraska and northern Mexico. It was introduced from Europe and is listed as Moldavian dragonhead. The most generally cultivated species is (*D. canariense*), or Canary Balm of Gilead.

**Dracon'tium**, a genus of tropical American araceous plants. They comprise six species distinguished by a fetid flower, tall peduncle, trifid leaves, and tuberous root. *D. polyphyllum* has been recommended as an antidote for snake bites. The skunk cabbage, *Symplocarpus foetidus*, pharmaceutically known as *Dracontium foetidum*, was formerly assigned to this genus. See SKUNK CABBAGE.

**Draft**, a written order for the payment of a sum of money addressed to some person who holds money in trust, or who acts in the capacity of agent or servant of the drawer. Documents of this kind often pass between one department of a bank or mercantile house and some other department, and are distinguished from bills of exchange and checks, in not being drawn upon a debtor. One reason for using them is the convenience in keeping accounts and having vouchers for payments.

**Draft Riots**, in New York, July 1863, were serious disturbances caused by the military conscription or drafts (q.v.) of that year, which met with a storm of denunciation from Democratic leaders and followers alike. The former proclaimed it unconstitutional, because military service was due only to the States; dangerous, as liable to absorb all the State militia and civil officials into the Federal service; and partisan in execution, the quotas having been gerrymandered to throw an enormous disproportion on the Democratic districts. This last was true, but was the work of subordinates, and was corrected by the War Department on protest. The

## DRAFTS

rank and file execrated it as a class measure, shifting the burden from the rich, to whom \$300 was a trifle, to the poor, who could pay only with their blood, and were least able to leave their families. The only answers were the nation's need, the law of nature that all burdens fall thus on the poor, and the government's wages, bounties, and pensions which strained it to relieve distress. But the legal and party arguments reinforced the class hatred and anti-war prejudice, and Gov. Horatio Seymour, the head of the Democratic party, sent his adjutant-general to Washington about 10 July to urge the postponement of the draft, on the ground of this popular excitement.

The drafting began, however, on Saturday morning, 11 July, at each provost-marshal's or assistant's office; which in the Ninth District, a Democratic stronghold, was at Third Avenue and 46th Street. The method was to place the enrolled names in a wheel and turn it, the first names coming out up to the assigned quota being the conscripts. A large crowd assembled, but made no disturbance; and the names drawn were published in the Sunday papers. Many of the poorer ones, incited and organized by political leaders, met secretly and formed associations to resist; and on Monday morning, parties went around the shops compelling workmen to leave their tasks and join the procession. The drawing was resumed at 10 A.M.; in a few minutes several paving-stones, one after another, were hurled through the windows into the midst of the crowd, smashing the furniture; and in another moment the mob broke in the door, wrecked everything inside but the wheel, beat one of the deputies into insensibility, and set fire to the building, though it was inhabited above. The whole block was shortly in flames; and when the firemen arrived, the hydrants were denied them till the conflagration was past help. The militia were nearly all in Pennsylvania, where Gettysburg had lately been fought, and the few garrison regulars and marines were under different commands; so that the Federal Gen. Wool, the State Gen. Sanford, and Mayor Opdyke, held separate authority with no deciding power. The mob increased, and began wreaking vengeance on political opponents and their property, burning and pillaging; and thieves and toughs, seeing their opportunity, flocked out and joined. Fifty marines, sent to disperse the 46th Street mob, fired blank cartridges, and were instantly routed and chased far along the streets by the rioters, many of them women and children. This changed the mob's attitude from defense to aggression; a squad of police was set upon and one killed. Then their wrath was turned on the negroes, as the cause of the "Black Republican War." These were beaten and stoned to death, and hanged to lamp-posts; hotels and restaurants having colored servants were invaded in search of them, and the movables smashed or stolen. In the afternoon the Colored Half-Orphan Asylum, with 700 to 800 children and nurses, was broken into, gutted and set on fire, the inmates being driven into the street while the women of the mob carried off the furniture. The armory on Second Avenue was broken open with stones and sledge-hammers to secure the arms, the police who bravely defended it driven out, and it was fired. All business and trade were suspended. In the lower

part of the city the office of the *Tribune*, the chief Republican paper, edited by the abolitionist, Horace Greeley, was attacked and about to be set on fire, but the police drove out the rioters. The entire block on Broadway which held the draft office was burned, with the provost-marshal's and the postmaster's private residences, a station-house, a hotel whose proprietor refused liquor to the mob, and other dwellings; and other houses were burned in the upper part. All that day and night the city was protected only by the police, many of whom lost their lives. At midnight a heavy rain dispersed the rioters for the time.

Tuesday was far worse, though the forces of order had begun to gather. The mobs too had swollen so that an army was needed; when bands were dispersed by the military, they gathered elsewhere and continued murder and depredation. Twenty negroes probably had been murdered Monday; far more perished Tuesday, and whole negro neighborhoods were burned out. Lieut. Wood with 150 regulars from Fort Lafayette fired a ball cartridge into a mob, killed a dozen and broke it up, but no officer could be ubiquitous. Col. O'Brien, who had dispersed a mob, sprained his ankle and stepped into a drug store; ordered out by the terrified proprietor, the mob murdered him and dragged his carcass up and down the street, mutilating and trampling on it. Gov. Seymour issued a proclamation summoning the rioters to disperse, but it was so insufficient that he was forced to issue another putting the city under martial law. Meantime the secretary of war had ordered home the militia regiments in Pennsylvania, and they began to arrive on Wednesday; the draft was announced as temporarily suspended; and the mob was so thoroughly beaten and cowed on Wednesday afternoon that cavalry regiments paraded the city at night without meeting any resistance. Isolated gangs prowled about even on Thursday, but they were mere criminals and soon slunk away. The property-holders had formed associations for self-protection, and the danger was mainly at an end by Thursday morning. The losses of these four days were never known. The bills of mortality for the week were 450 above the average; 90 deaths from gunshot wounds were reported; and it was said that many rioters were secretly buried by their friends. Claims for property damage were filed to over \$2,500,000; though heavily scaled, something like \$1,500,000 were paid. The draft was resumed on 19 Aug., and ended on the 28th. Consult: 'Official Records,' XXVII. Pt. 2, 1889; Fry's 'New York and the Conscription of 1863,' 1885; Greeley's 'American Conflict,' Vol. II., 1866.

**Drafts, or Military Conscriptions,** in the history of the United States, aside from the drafts of the Confederate States of 18 July 1863, and the sweeping one of 17 Feb. 1864, which was in action all through the latter part of the Civil War — are known by those of 1814 and 1863. The former, however, was such only in purpose, as it never went into action or became law. In the Revolution, the regular armies of the United States were recruited by drafts from the State militia (see *CONTINENTAL ARMY*), but these transfers were made by requisitions on the States, who furnished and officered their quotas in such bodies as they chose. The Constitution gave Congress the twofold power to

"raise armies," and to "organize and arm the militia." Knox in 1790, and Jefferson in several annual messages urged a thorough plan for the latter, classifying the militia independently of the State organizations, and drafting one from each section as needed; but jealousy of the States' rights over the militia was too strong. In the War of 1812, requisition was made on States for militia to replace coast garrisons, denuded for invasion of Canada, but Connecticut and Massachusetts refused on the ground that as this country was not invaded, there was no constitutional right to summon the militia. When this excuse failed, others were found; in 1813 a militia organization bill passed the House, but failed in the Senate. In 1814 the increasing exigencies forced a bill through Congress (Senate 10 Nov.; House 9 Dec.), on suggestion of the New York and Virginia legislatures; but even its Democratic supporters doubted its being either constitutional or useful, and the House loaded it with an amendment on which the Senate disagreed, as doubtless intended. The war ended shortly after.—In the Civil War, volunteering filled the armies during the first two years, the quotas being apportioned by congressional districts; then the numbers grew scant, and on 3 March 1863 the "Conscription Bill" passed. The intent was the old plan of militia classification and draft, but the Democrats held it unconstitutional, and their arguments were unanswerable. The Republicans therefore fell back on the broad power to "raise armies," as implying the right to fix the method of so doing; this in turn was incontrovertible, and upheld by the Supreme Court. The State militias were ignored. All able-bodied citizens between 18 and 45 were summoned to the national defense, and were to be enrolled from 1 April on by the provost-marshal; quotas under future calls not filled by volunteers after a certain period were to be made good by lot from the enrollment; conscripts could furnish substitutes or buy exemption for \$300; all persons refusing obedience to be punishable as deserters. Early in May 300,000 more troops were called for; many Eastern cities were already in arrears, and the poorer classes, especially those politically hostile to the War, grew very bitter at the real hardships and the real and alleged unfairness of the conscription. The invasion of Pennsylvania by Lee had drawn the Northern State militia thither in June and early July, and the mob in several places undertook to resist the draft. The police easily put down the rising except in New York, where the great numbers of the rioters, reinforced by the criminal classes, gave the city into their hands for two days, 13 and 14 July, and they were not suppressed till the 15th. (See DRAFT RIOTS.) The drafts interrupted by these disorders were resumed and carried through. But their chief value was in goading the districts into filling the quotas by volunteers; however legal, they were incredibly scanty of direct results. The commutations were toward a third of the whole, the exemptions nearly a half, and the number held and their substitutes together were but a sixth to a fifth. Also, many of the substitutes turned deserters or "bounty-jumpers." It has been estimated that of over 3,000,000 enrolled, less than 100,000 men were obtained by the drafts.

**Drage, Geoffrey**, English publicist: b. 1860. He was educated at Eton and Oxford and is a barrister of Lincoln's Inn and the Middle Temple, but has never practised. He was secretary of the Royal Commission on Labor, (1891-94), and M.P. for Derby (1895-1900). He has published 'Criminal Code of German Empire with Prolegomena and Commentary' (1885); 'Cyril,' a novel (1889, 8th ed. 1899); 'Eton and the Empire' (1890); 'Foreign Reports of Royal Commission on Labor'; 'Eton and the Labor Question' (1894); 'The Unemployed' (1894); 'The Problem of the Aged Poor' (1895); 'The Labor Problem' (1896).

**Drag'oman**, the general name given in Levant countries to an interpreter, or to a guide to foreigners. The dragoman is, however, much more than the Italian *cicerone*, or the French *commissionnaire* or *valet de place*. In Syria, for example, he is a contractor for the management of expeditions, and undertakes to solve all the difficulties that arise between the traveler and the natives. The dragomans attached to embassies have special privileges. Student dragomans is a term sometimes given to student interpreters preparing for the British consular service in the Orient. The dragoman to the porte, through whom diplomatic negotiations with foreign powers were formerly carried on, used to be a very important dignitary.

**Dragon**, a genus of arboreal lizards, of which the most familiar is *Draco volans*. The genus is especially remarkable for the extension of the skin of the sides on the prolonged posterior ribs. A parachute is thus formed which enables the dragon to take rapid swoops from branch to branch. The tail is very long; the skin of the throat forms a loose wattle; the colors are particularly brilliant. There are several species inhabitants of the East Indies, not including Ceylon. The term dragon has also been applied in modern times to a large lizard (*Thorictis dracana*) found in Brazil and Guiana. It attains a length of three feet, most of which goes to the tail. *Tejus* and *Ameiva* are allied genera. See LIZARDS; REPTILES.

**Dragon**, a fabulous monster found in the mythology of nearly all nations, from Greece to China, where it forms the national ensign. It is usually depicted as a huge serpent of abnormal form. Ancient legends represent the dragon as a snake, watching as sentinel the Garden of the Hesperides, or guarding the tree on which was hung the Golden Fleece at Colchis. In other places it appears as a monster, making the neighborhood around its cave unsafe, and desolating the land; its death being ascribed to a hero or god, providentially appointed for the task, which was a service to all mankind. The dragons which appear in early paintings and sculptures are invariably representations of a winged crocodile.

In Christian art the dragon is the emblem of the Devil. As the form under which Satan, the personification of sin, is depicted, the dragon is met with in pictures of St. Michael, and St. Margaret, when it typifies sin conquered; it also appears under the feet of the Saviour, and under those of the Virgin, in both cases with the same idea. The dragon also typifies idolatry. In pictures of St. George and St. Sylvester, it suggests the conquest of paganism by Christianity. In pictures of St. Martha, it symbolizes the inun-





DRAGON FLIES.





## DRAGON — DRAGON-FLY

dation of the Rhone, spreading pestilence and death, and arrested in its course of devastation by the miraculous interposition of Mary's sister. St. John the Evangelist is sometimes represented holding a chalice, from whence issues a winged dragon, in which case it symbolizes the poison which was miraculously eliminated from the chalice wine, into which hemlock had been put. The dragon appears on the shield of the most famous of Christian heroes, as well as on the helmets of kings and generals. It is found on English shields after the time of William the Conqueror. In modern heraldry, it appears on the shield and helmet; as supporter, it is called a lindworm when it has no wings, and serpent when it has no feet; when it hangs by the head and wings it means a conquered dragon.

**Dragon**, in astronomy, one of the ancient northern constellations, in Latin, *Draco*. The figure is that of a serpent with several small coils. It appears at a very ancient date to have had wings in the space now occupied by the Little Bear. Fable says that Juno translated to the heavens the dragon which kept the golden apples in the Garden of the Hesperides, and which was slain by Hercules. See *HESPERIDES*.

**Dragon-fly**, an order of insects, the *Odonata*, allied to the may-flies and *Ephemerids*, with long, slender bodies, very large mobile heads, immense eyes, short antennæ, and two pairs of long, nearly equal wings of a firm and glossy texture, and closely netted with many veins. The mandibles are powerful, the mouth-parts being so fused and solidified as to form a most effective trap for catching the small insects upon which dragon-flies feed. The pro-thorax is small, the meta-thorax and meso-thorax large, and the meso-thorax slopes over the meta-thorax, by which arrangement the spinous legs are thrust forward, so that they project under the head. These legs are unfitted, and are never used, for walking, but as instruments for catching and holding prey or for clinging to plants. The hind body is proportionately longer than in any other group of insects; it has 10 evident segments, the hindmost carrying a pair of stiff unjointed cercopods. The male genital armor is situated on the second abdominal segment — a position unknown in any other insect; and the intromittent organs are separate from the ejaculatory ducts, the latter being near the extremity of the abdomen. "Therefore," as Howard explains, "before copulation the male curves his abdomen around beneath, so that the ninth segment of the abdomen is brought into contact with the second, thus transferring the fertilizing fluid to the intromittent organ. The tip of the abdomen of the female is bent around and joins with the underside of the second segment of the male's abdomen, the male frequently grasping the female around the neck with certain appendages at the extremity of his abdomen. This complicated embrace once obtained is likely to be held during the whole process of egg-laying, even in many cases when the deposition takes place under water.

Dragon-flies are semi-aquatic in all their life and habits. The eggs are laid in the stems of submerged plants by some species, which are provided with an instrument for cutting through the bark, each egg being pushed into the cutting as the female moves down the stem. As a rule, however, the eggs are dropped into the water, or

washed off by dipping the tip of the abdomen. The number of eggs laid is large, exceeding 100,000 in the case of many *libellulids*.

When the eggs hatch the young immediately begin a life of activity and depredation. Molts follow one another rapidly, and the first larval form soon changes into a "nymph," a form equivalent to the pupa stage of other insects, but differing in the fact that activity continues. These young remain under water, have short, broad hinder bodies, walking legs, feelers, and breathe by means of "rectal gills." They prey upon everything edible, including their own weaker brethren. To assist them in doing this the mouth-parts are modified into an insect-catching trap, forming an innocent-looking mask, within which are concealed grasping organs, ready to be shot out when an unsuspecting little animal creeps too near and the mask is suddenly lifted. When the broad and flattened nymph has become full-grown it crawls out of the water upon some warm rock, where presently its skin splits open and the adult dragon-fly emerges. These changes are easily studied by breeding dragon-flies in an aquarium.

The voracity of dragon-flies is notorious. They seize and devour all sorts of insects, including smaller species of their own race, and sometimes moths, butterflies and wasps. Flies form their principal fare, however, and they consume vast quantities of house-flies and mosquitoes, but their service in killing the latter pests is mainly done during the larval stages. They abound, in midsummer, in most parts of the world, and sometimes appear in enormous flocks, millions moving across the country in company; such swarms are the result of various local conditions, and are not migrations, properly speaking. The great beauty which most of the species have, glittering in metallic hues and skimming through the sunshine on brilliant, gauzy wings, has made them objects of universal admiration; but this admiration is strangely coupled with a popular fear and superstition toward them. Thus they are commonly known among American children as "devil's darning-needles," and are accused of an intention to sew up the ears of bad boys, or work mischief in the hair of naughty girls. The negroes of the Southern States call them "snake-doctors," and say they feed and nurse ailing serpents. In Great Britain, they are known as "horse-stingers," "flying-adders," or "penny-adders," and are believed to carry a poisonous sting in their tails. All these superstitions are calumnies upon a harmless and beneficial insect.

About 2,000 species of dragon-flies have been described, of which an eighth are peculiar to the United States. The order contains two well-marked groups: the *Libellulida*, or dragon-flies proper, and the *Agriionida*, or damselflies, distinguished broadly by the fact that in the former the front wings are dissimilar, and are held horizontally in repose; while in the latter the wings are alike and are held vertically when the insect rests. Another distinguishing feature is the fact that in the *Libellulida* the eyes are sessile, sometimes meeting on the top of the head, while in the *Agriionida* the eyes are constricted at the base and peduncled. An important subdivision of the *Libellulida*, regarded by some as a separate family, is the *Æschnida*, which is characterized by the fact that the eyes touch on the top of the head. To this group belong many of the largest and most gaudy dragon-flies.

## DRAGON ROOT—DRAHMS

An excellent illustrated account of North American dragon-flies will be found in L. O. Howard's 'The Insect Book' (1901), which contains further references. For British species consult Lucas' 'Handbook of British Dragon-flies' (1899).

**Dragon Root, or Green Dragon** (*Arisæma dracontium*), a plant of the *Arum* family, abounding in wet woods and along streams, from Maine west to Minnesota; and southward to Florida and Texas. The spathe envelops the greenish spadix, the upper part of which tapers into a long, slender appendage, extending beyond the apex of the spathe, sometimes as much as six inches. The corm contains an acrid or pungent sap, which is supposed to possess curative properties, and is much used as a household medicine, in the region of its growth.

**Dragon-tree.** See DRACÆNA.

**Dragonnades**, drăg-ō-năds', the name given to the persecutions directed against the Protestants chiefly in the south of France, during the reign of Louis XIV. They commenced in Poitou, and their nature may be understood from a letter from Louvois, the French minister, to Marillac, the governor of the province. It is dated 18 March 1681, and says, *inter alia*, that his majesty wishes that the greatest number of troopers and officers be billeted on the Protestants, and that when a just division makes them liable only to 10 they may be saddled with 20. Marillac, thus instructed, lost no time in giving full effect to the letter, and the Protestants were everywhere subjected to cruel extortion and gross indignity at the hands of a brutal soldiery. These dragonnades were practised with still greater atrocity in Béarn 1684, and in all the other provinces where the Protestants existed in any considerable numbers. Resistance was attempted in several instances; thousands of the most enlightened merchants and skilful workmen left the country; carrying their talents and industry into the service of its enemies; but the far greater number, seeing resistance hopeless, and overcome by terror, gave in a feigned adhesion. While the excesses of the dragonnades should be absolutely condemned, it should not be forgotten that the aggressive fanaticism displayed by the Protestant sects in numerous atrocities, to a large extent balance the scale against the cruelties perpetrated in the execution of this measure.

**Drag'onet**, the common name of certain fishes of the family *Gobiidae* (q.v.). The gemmeous dragonet (*Callionymus lura*), a beautiful fish with a large head and a smooth tapering body, is found in the British seas. See GOBY.

**Dragon's Blood**, a resinous juice obtained by incision from several different plants found between the tropics;—from the trunk of the *Pterocarpus draco*, a tree of the natural order *Leguminosæ*, growing in the West Indies, which yields American dragon's blood; from the *Calamus draco*, a palm of the East Indies; from a *Dalbergia* in Guiana, and a *Croton* in South America; and from the *Dracana draco* (order *Liliaceæ*), which is most celebrated in connection with the Canary Islands. A historic tree of this last species, at Orotava, acquired enormous dimensions, and was visited and celebrated by almost every traveler, including Humboldt, but was destroyed by a storm in 1867. It was

supposed to have been about 5,000 or 6,000 years old.

Dragon's blood is obtained, in commerce, in three principal forms—in that of oval masses of the size of a pigeon's egg, enveloped with leaves of the pandanus; in cylinders covered with palm leaves; and in irregular masses, marked with impressions of leaves; that in oval masses is the most esteemed.

Dragon's blood is opaque, of a deep reddish-brown color; brittle, and has a smooth and shining conchoidal fracture; when in thin laminae it is sometimes transparent; when burned it gives out an odor somewhat analogous to benzoin; its taste is a little astringent; it is soluble in alcohol, and the solution will permanently stain heated marble, for which purpose it is often used, as well as for staining leather and wood. It is also soluble in oil, and enters into the composition of a very brilliant varnish, which is much esteemed by artists. Its quality may be proved by making marks on paper; the best leaves a fine red trace, and commands a very high price. It was formerly in high repute as a medicine, but at the present time is very little used. An astringent resin, obtained from the *Eucalyptus resinifera* of Australia, sometimes gets the name of "dragon's blood" in that country.

**Dragon's Mouths**, a strait on the coast of Venezuela, running between the Island of Trinidad and the Paria Peninsula, and leading into the Gulf of Paria.

**Dragoon**, a mounted soldier, first introduced into the French army about 1585, and trained originally to fight chiefly on horseback, but, if necessary, on foot also, and mounted, armed, and exercised accordingly. Experience proving that they did not answer the end designed, they were hardly ever used in infantry service latterly, and now form a useful kind of cavalry. The term dragoon probably comes from *dragon*, a short species of carbine carried in 1554, on the muzzle of which, from the old fable that the dragon spouts fire, the head of the monster was worked. The first dragoon regiment raised in Great Britain was the Scots Greys (1681). There are at present in the British army three regiments of dragoons, and seven of dragoon guards, all being mounted and accoutred more after the fashion of heavy (or medium) cavalry than the hussar regiments. The three dragoon regiments are the 1st (Royal) Dragoons, the 2d Dragoons (Royal Scots Greys), and the 6th (Inniskilling) Dragoons. Both dragoons and dragoon guards are armed with carbine and sabre, and have metal helmets (except the Scots Greys).

**Dragon Bird.** See UMBRELLA BIRD.

**Draguignan**, dră-gên-yăn, France, town, capital of the department of Var; 41 miles northeast of Toulon. It was founded in the 5th century. Pop. 8,645.

**Drähms**, August, American Congregational clergyman: b. Yarmen, Pomerania, 4 March 1849. His parents emigrated to the United States in 1856, and his early education was received in the public schools of Geneva, Ill. In 1863, he enlisted in the 17th Illinois cavalry and served to the end of the War. He afterward studied at Wheaton College, and the Garrett Biblical Institute at Evanston, Illinois,

## DRAIN-PIPE — DRAINAGE

and entered the Congregational ministry at Oakland, California, 1878. He is resident chaplain of the state prison at San Quentin, Cal. He has written 'The Criminal: a scientific study; with an introduction by C. Lombroso' (N. Y., 1900).

**Drain-pipe**, a pipe used in draining, commonly of tile, but sometimes of wood or metal. See **SEWER PIPE**; **TILE**.

**Drainage**, in agriculture, a method of improving the soil by withdrawing the water from it. Though practised by the Romans, and though the value of draining was expounded by Walter Blithe in the middle of the 17th century, it was not till after the middle of the 18th century that the importance of draining began to be understood in Great Britain. The public attention is said to have been then excited by the practice of Elkington, a farmer of Warwickshire, England. But it was James Smith of Deanston, Perthshire, Scotland, who about 1823 led the way in the modern practice of thorough draining.

The successful practice of draining in a great measure depends on a proper knowledge of the various strata of which the earth is composed, as well as of their relative degrees of porosity, or capability of admitting or rejecting the passage of water through them, and likewise of the modes in which water is formed, and conducted from the high or hilly situations to the low or level grounds. In whatever way the hills or elevations that present themselves on the surface of the globe were originally formed, it has been clearly shown, by sinking large pits, and digging into them, that they are mostly composed of materials lying in a stratified order, and in oblique or slanting directions downwards. Some of these strata, from their nature and properties, are capable of admitting water to percolate or pass through them, while others do not allow it any passage, but force it to run or filtrate along their surfaces, without penetrating them in any degree, and in that way conduct it to the more level grounds below. There it becomes obstructed or dammed up by meeting with impervious materials of some kind or other, by which it is readily forced up into the superincumbent layers, where they happen to be open and porous, soon rendering them too wet for the purposes of agriculture; but where they are of a more tenacious and impenetrable quality, they only become gradually softened by the stagnant water below them; by which the surface of the ground is, however, rendered equally moist and swampy, though somewhat more slowly than in the former case.

Where grounds are in a great measure flat, and without degrees of elevation sufficient to permit those over-proportions of moisture that may have come upon them from the higher and more elevated grounds to pass readily away and be carried off, and where the soils of the land are composed or constituted of such materials as are liable to admit and retain the excesses of moisture, they are exposed to much injury and inconvenience from the retention and stagnation of water. Such lands consequently require artificial means to drain and render them capable of affording good crops, whether of grain or grass.

Wetness of land, so far as it respects agriculture and is an object of draining, may gener-

ally depend on the two following causes:—first, on the water which is formed and collected on or in the hills or higher grounds, filtrating and sliding down among some of the different beds of porous materials that lie immediately upon the impervious strata, forming springs below, and flowing over the surface, or stagnating underneath it; and, secondly, on rain or other water becoming stagnant on the surface, from the retentive nature of the soil or surface materials, and the particular nature of the situation of the ground. The particular wetness which shows itself in different situations, in the forms of bogs, swamps, and morasses, for the most part proceeds from the first of these causes; but that superficial wetness which takes place in the stiff, tenacious, clayey soils, with little inclination of surface, generally originates from the latter.

**Drains**.—The drains used in land drainage may be divided into two classes—open and covered drains. These again may each be subdivided into drains intended merely to act as water-courses, and drains which, in addition to acting as water-courses, are also intended to carry off the surplus water from the land through which they pass.

**Open Drains**.—The rudest forms of open drains are the deep furrows, lying between narrow highbacked ridges, which are still to be found in some parts of the country, with their accompanying water-furrows ("gaw" furrows or "grips") for discharging their streams. These are only meant to carry off the surplus water after the soil is completely saturated. In doing so, however, they carry along with it all the best portions of the soil, and of the manure which may have been spread upon its surface.

**Open Drains as Water-courses**.—The ordinary ditch (dike) is the common form of this kind of drain, which, though necessary to a certain extent, ought, nevertheless, to be sparingly seen where a perfect system of drainage has been effected. They are constant sources of annoyance and expense from their sides crumbling in, the numerous weeds which they harbor, and the thorough scouring which they require every year. Open ditches occupy an important place in the early stages of draining bogs; but after the bog has become consolidated the greater portion of them may be dispensed with, and their places supplied by large covered drains.

**Open Drains for collecting Water from the Land through which they pass (Sheep-drains)**.—These are employed in drying the surface of mountain pastures, where a more expensive and perfect system of drainage would not yield an adequate return for the outlay. They consist of trenches of 12 or 16 inches in depth and 18 in width, placed so as to intercept all the water which may flow from portions of land above them. They are opened at intervals in a direction nearly transverse to the line of the greatest slope, and should have just sufficient inclination to keep the water flowing toward the mains or leaders. These latter should be cut in the hollows, or in such other places as will permit the small drains or feeders to empty themselves most readily into them, and be made to discharge into the nearest water-courses.

**Covered Drains**.—We now come to the consideration of the more important description of drainage—the removal of water by means of

## DRAINAGE

covered drains. The simplest of all the forms of these are what are called mole-drains, and they are formed by means of a machine called the mole-plough. This machine consists of a wrought-iron frame on four wheels, the front pair being connected with worm and chain steering. A coulter with pointed sock, capable of being raised and lowered to regulate the depth of the drain, is attached to the frame. The "mole," an oval piece of iron  $3\frac{1}{2}$  inches in diameter, follows the sock, to which it is attached by a short chain. The track which the mole leaves in the ground is the water channel. This machine is dragged through the soft clay, which is the only kind of land on which it can be used with propriety, by means of a windlass on the fore end of the frame and a double length of wire-rope wound by an engine on the higher part of the field. A team of horses returns it to the lower side, out of work.

*Wedge-drain.*—The wedge-drain, like the mole-drain, is merely a channel formed in the subsoil, and, like it, can only be used in pasture lands. In forming wedge-drains, the first spit, with the turf attached, is laid on one side, and the earth removed from the remainder of the trench is laid on the other. The last spade that is used is very narrow, and tapers rapidly, so as to form a narrow wedge-shaped cavity for the bottom of the trench. The turf first removed is then cut into a wedge, so much larger than the size of the lower part of the drain that, when rammed into it with the grassy side undermost, it leaves a vacant space somewhat triangular in shape in the bottom of six or eight inches in depth.

Permanent drains are of two kinds, stone and tile drains.

*Stone-drains.*—These are either formed on the plan of open culverts of various forms, or of small stones in sufficient quantity to permit a free and speedy filtration of the water through them. As a specimen of the former of these, we may instance the *box-drain*, which is formed of flat stones neatly arranged in the bottom of the trench. The largest and flattest stones are used in laying the bottom and for covers; the smaller ones are placed on the sides, the whole forming an open tube. The second description of stone-drains, generally known as the broken-stone or rubble drain, is not so thoroughly effective as the first.

*Tile-drains or Sewer-pipe drains.*—Of all the materials which have yet been brought forward for forming the conduits of drains, none are so well fitted for the purpose as tiles or pipes of burnt clay. Draining tiles, especially those in the form of pipes, possess all the qualities which are required in the formation of drains, affording a free ingress to water, while they effectually exclude vermin, earth, and other injurious substances. When first introduced they were of clumsy construction, and being handmade, sold at a high price. They are now made by machinery, and their expense is very materially lessened. Pipe tiles, which combine the sole and cover in one piece, have been made of various shapes, but the best form appears to be the cylinder. Good pipes are straight, smooth, and free from flaws, and when struck should ring clearly. Durability is shown if the wet pipe will dry quickly before a hot fire without crumbling. Where a sudden descent occurs in the course of a drain, or where there is a run-

ning sand or a boggy place, pipes of one size should either be entirely sheathed in larger ones, or they should be furnished with collars. These collars are merely short sections of pipes of such a size as to fit upon smaller ones, by which means the smaller ones may be so joined end to end as to prevent them from slipping down past each other.

The drawing off of the pent-up waters which are the sources of springs is a department of draining which requires, for its successful practice, a considerable knowledge of the different varieties of strata. When the theory of springs is understood, and a knowledge of the strata obtained, the judicious application of a few simple drains, made to communicate with the watery layers, will often dry swamps of great extent, where large sums of money expended in forming furrow drains in the swamp itself, would leave it but little improved.

In the laying out of drains, the first point to be determined is the place of outfall, which should always afford a free and clear outlet to the drains, and must necessarily be at the lowest point of the land to be drained. This should be ascertained by a beveling instrument; and where a large extent of work is to be done, a competent surveyor should always be employed. The outfalls should be as few as possible, and each one should be carefully set in brickwork and covered by a grid hinged at the top to prevent the ingress of rats and moles, but capable of giving way to a sudden rush of water from the drains above. The next point to be determined is the water level or water table. This may be ascertained by digging test holes in different parts of the field and noticing the height to which the water rises in them. In an undulating field the height will vary in different places, but the knowledge gained by means of the test holes of the nature of the soil and subsoil will indicate the depth of draining required. In general it will be found that in clay land the drains should be shallow and close together, and in sandy or light land deeper and wider apart; the looser nature of the lighter soil permitting the rapid percolation of water, and allowing the drains to draw from a wider area. Drains in arable land must be beyond the influence of agricultural implements; not only out of the reach of plough or cultivator, but too deep to be displaced by their passing weight. Less than two feet six inches from the surface is unsafe, except in very stiff clay pasture land which is never disturbed. The depths usually adopted in practice for the various classes of soils are as follows:

Stiff clay.....	2 ft. 6 in. to 3 ft.
Medium soils.....	3 ft. 3 in. to 3 ft. 6 in.
Light soils.....	3 ft. 6 in. to 4 ft. 6 in.

As to the distance apart, experience has established a rule that in clay soils a drain will "draw" an area of from 5 to 6 times its depth, on medium soils 7 to 9 times, and on light soils 8 to 10 times its depth. Thus 3-foot drains in the first case might be 15 feet apart, in the second 24 feet, and in the third 40 feet apart. Submains may be necessary in an undulating field, and in all cases they are desirable where the minor drains would otherwise be more than 10 chains in length. The rate of fall of any drain must not be less than 1 in 200. All drains should be kept as far as possible from

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the roots of trees, and curves are to be avoided, except at the junction of minor with main drains or submains, when the junction must form an acute angle, the smaller drain curving towards the larger drain and entering it from above. Two minor drains must not enter a large drain opposite to each other, or the stoppage thus caused will result in the deposition of silt and consequent chokeage of the drain.

Drains are cut from the lowest point upward and the pipes laid in each section day by day. To ascertain if the pipe bed is being laid perfectly true, three leveling staves or "boning" rods are used. Each consists of a staff and crosshead, and by placing them at various points in the drain and sighting over the crossheads, uniformity of the bed is determined. The surface soil in cutting the drains ought to be laid on one side of the trench and the subsoil upon the other side, and each should be returned carefully to its original position. The size of the pipes to be used is dependent upon a number of factors, such as character of soil and subsoil, gradient, rainfall, and length of drains; but in practice it is found most profitable to use  $2\frac{1}{2}$ -inch to 3-inch pipes for minor drains, and 6-inch, 8-inch, or 10-inch for mains and submains. The number of pipes required per acre is found by dividing the area of an acre in square feet by the distance between the drains in feet, provided the pipes are one foot in length. The following table will be of value in this particular:

Minors	{	Lengths up to 500 feet, 2 in.
		Lengths 400 to 700 feet, $2\frac{1}{2}$ in.
		Lengths 500 to 1,000 feet, 3 in.
Mains	{	2 to 3 acres.... 3-inch tiles.
		4 to 6 acres.... 4-inch tiles.
		10 to 15 acres.... 6-inch tiles.
		20 to 40 acres.... 8-inch tiles.
		40 to 100 acres.... 10-inch tiles.

The tools used in the formation of drains are few in number, and of a very simple description. They consist of a set of spades—generally three of different sizes—gradually diminishing in width to suit the different parts of drains. For taking out the last narrow spit, to form the seat for the draining pipe, long, narrow, triangularly shaped spades, called bottoming tools, are used. There are also scoops of various widths, furnished with long handles, and rounded or flattened in the soles according as they are required to finish the bottom of the drain for the reception of stones, a horse-shoe tile and sole, or a draining pipe. For the purpose of laying pipes in minor and deep drains an instrument called a pipe-layer, consisting of a short rod attached at a right angle to a long handle, which enables the workman to lay the pipes without going into the drain or reaching the bottom with his hand, is employed. Where the subsoil is strong or indurated, a hand-pick or a foot-pick is required to loosen it before it can be shoveled out.

*Benefits of Drainage.*—The following are among the benefits arising from thorough drainage:

1. Removal of superfluous water. Not only is the standing water at the surface carried off, but the water-table is lowered, increasing the depth of soil. Energy that would otherwise be required for evaporation of water is thus saved for the immediate benefit of vegetation.

2. Improves soil texture. Drained soils are

more friable, less lumpy, offer less resistance to plant roots, and are of better texture in every way, than undrained soils.

3. Increases root pasturage. Agricultural literature is full of testimony to the benefits of deep tillage. The deeper the soil is stirred the greater its productiveness. Plant roots penetrate to a depth of several feet under favorable conditions such as drainage supplies. Root pasturage is also increased by the increase of surface presented by the much finer division of soil particles.

4. Increases soil fertility. It prevents loss of fertility by water passing over the surface. It adds to the fertility by sending summer showers down through the soil, instead of over them, enabling the crop to use the nitric acid and ammonia brought down. It increases the effect of manures by bringing them more quickly into solution and into more intimate contact with plant roots; and it increases the absorptive power of soils for fertilizing matter in solution.

5. Makes tillage easier. By clearing up waste places and covering ditches the field is brought into better shape for use of labor-saving machinery. Waste land is reduced, and the better texture of soil, its finer tilth and greater friability decrease draft and increase the effectiveness of tillage implements.

6. Lengthens the growing season for crops. Frost comes out earlier in the spring and the land becomes earlier warmed. Evaporation lowers temperature, but drainage removes water without evaporation. A well-drained soil is  $12^{\circ}$  to  $14^{\circ}$  F. warmer than a soil full of stagnant water. The sun's rays penetrate to a greater depth, and warm summer showers have a greater effect. The season is lengthened by adding the days in summer after heavy rains when undrained soils cannot be tilled, and crops come to a standstill; coming of the autumn is delayed until later, and the soils are warmer throughout the season.

7. Assists disintegration. Frosts penetrate deeper in winter in drained soils, assisting in unlocking the stores of mineral plant food. More surface is exposed to the action of disintegrating agents, and the soil presents conditions more favorable to their action throughout the season.

8. Favors nitrification and bacterial action. Plants are largely dependent on the decomposition of organic matter in the soil for their supply of nitrogen. This change is brought about by the action of ferments or bacteria which thrive only under certain conditions of temperature and moisture. Drainage supplies the most favorable condition for their development; it also favors the growth of the nitro-bacteria found on the roots of leguminous plants, which by their means appropriate free nitrogen from the air.

9. Prevents heaving. The effect of stool-ice in throwing out young plants in winter is often to diminish seriously and even destroy the crop. Drainage dries up the surface soil and prevents the formation of stool-ice.

10. Lessens washing and diminishes violence of floods. By increasing the absorptive power of the soil less water is left to pass over the surface in a rainy season, so that washing and floods are materially lessened.

11. Improves the quantity and quality of



## DRAINAGE TUBES — DRAKE

crops. That the yield of crops is much greater on drained soils hardly needs to be substantiated, while the more vigorous growth of plants renders them much less susceptible to the attacks of fungi or the ravages of insects, thus improving the quality. Rust, mildew, blight, etc., are much less prevalent in crops on drained soils.

12. Diminishes the effect of drought. By making the season earlier tillage can begin sooner and save moisture from wasting. Plants are given a better start and root deeper, thus being less affected by a dry surface. The soil is deeper and has greater capacity for moisture. Its finer texture nearly doubles its capillary power over undrained soils. Ordinarily drainage increases the capillary power of soils from 25 to 40 per cent. A drained soil holds water like a sponge, an undrained clay like a dish.

13. Healthfulness improved. So well known is this fact that large towns have undertaken the drainage of adjacent swamps at public expense to render the region more healthful. See AGRICULTURE; SANITARY SCIENCE; etc.

Among the later authoritative books on drainage: Chamberlain, 'The Draining'; Klippart, 'Land Draining'; French, 'Farm Draining'; Miles, 'Land Draining'; Waring, 'Draining for Profit and Health.'

**Drainage of Mines.** See MINES, DRAINAGE OF.

**Drainage Tubes**, in surgery, an appliance invented by a distinguished French surgeon, M. Chassaignac. They are composed of india-rubber, from one eighth to three eighths inch in diameter, perforated with numerous holes, and of various lengths. They are introduced into the abscess or wound so that one end is in contact with the seat of discharge, while the other reaches to the surface of the skin. They are especially useful in chronic abscesses, but also in large wounds, such as those made by amputation, and in all cases where there is apt to be a deep accumulation of discharge.

**Drake, Alexander Wilson**, American artist: b. near Westfield, N. J., in 1843. He became a wood engraver and later taught drawing at Cooper Union, New York. From 1870-81 he was head of the art department of 'Scribner's Monthly' and after 1881 was director of the art department of the 'Century' publications.

**Drake, Benjamin**, American biographical writer: b. Mason County, Ky., 1794; d. Cincinnati, Ohio, 1 April 1841. He established and for many years edited the 'Western Agriculturist.' Among his publications are: 'Adventures of Black Hawk' (1838); 'Life of William Henry Harrison' (1840); and 'Life of Tecumseh' (1841). The last work is considered of especial historic value.

**Drake, Charles Daniel**, American lawyer: b. Cincinnati, 11 April 1811; d. 1 April 1892. He served several years in the navy, was admitted to the bar in 1833, and in 1834 took up the practice of law in St. Louis, where he became prominent in politics. In 1864 he was a member of the convention to revise the Constitution of Missouri; in 1867-71 he was United States senator; and in 1871-85 chief justice of the court of claims. He wrote 'Law of Suits by Attachment' (1854); 'Life of Daniel Drake' (1871); and published a collection of his

speeches under the title 'Union and Anti-Slavery Speeches' (1864).

**Drake, Daniel**, American physician: b. Plainfield, N. J., 20 Oct. 1785; d. Cincinnati, Ohio, 6 Nov. 1852. He was graduated from the University of Pennsylvania in 1815, and settled for a time in Cincinnati. He was professor of materia medica in Transylvania University, Ky., and taught in other medical schools till 1820, when he organized the Medical School of Ohio in Cincinnati; he was professor there, and in the University of Louisville, Ky. He wrote 'Pictures of Cincinnati and Miami County' (1815); 'Practical Treatise on the History, Prevention and Treatment of Epidemic Cholera' (1832); 'Systematic Treatise on the Principal Diseases of the Interior Valley of the North America' (1850-4); and was editor of the 'Western Medical and Physical Journal.'

**Drake, Sir Francis**, English navigator: b. probably in Tavistock, Devonshire, England, about 1540; d. off Porto Bello 28 Jan. 1596. He joined Sir John Hawkins in his last expedition against the Spaniards (1567), losing nearly all he possessed in that unfortunate enterprise. Having gathered a number of adventurers round him he contrived to fit out a vessel in which he made two successful cruises to the West Indies in 1570 and 1571. In 1572 with two small ships he again sailed for the Spanish main, captured the cities of Nombre de Dios and Vera Cruz, burned Porto Bello, captured and destroyed many Spanish ships, crossed the isthmus to the highest point of the dividing ridge, where, climbing a tree from whose tops the guides told him both seas could be seen, he gazed upon the vast waters of the South Seas, and with that touch of romantic enthusiasm that redeemed all his piracies, "besought Almighty God of His goodness to give him life and leave to sail once in an English ship in that sea." Drake arrived in Plymouth on Sunday, 9 Aug. 1573, during sermon-time, when the news of his return "did so speedily pass over all the church, and surpass their minds with desire and delight to see him, that very few or none remained with the preacher, all hastening to see the evidence of God's love and blessing toward our gracious queen and country."

In 1577 he fitted out a small squadron, consisting of his own ship the Pelican, the Elizabeth and three smaller vessels, and with these sailed from Plymouth on 13 December. On 20 August the squadron, now reduced to three ships, entered the Strait of Magellan, and here Drake changed his own ship's name from the Pelican to the Golden Hind. In 16 days they made the passage, then followed violent tempests for 52 days, during which the Marigold foundered with all hands and the Elizabeth parted with the admiral and resolved to return home. At Valparaiso Drake provisioned his ship from the Spanish storehouses, reached Callao on 15 Feb. 1579, found a rich prize off Cape Francisco (1 March) and another on 4 April. Drake now determined to return home by crossing the Pacific. He touched land at a creek on the northern side of the Golden Gate, then for 68 days together had no sight of land until he made the Pelew Islands. After refreshing three weeks at Ternate, and a thorough refit on the southwest coast of Java, he held for the Cape of Good Hope, and arrived in England 26 Sept. 1580.

## DRAKE

The queen paid a visit to his ship at Deptford, and knighted him on its deck.

In the autumn of 1585 Drake sailed with a fleet of 25 ships against the Spanish Indies, harrying Hispaniola, Cartagena, and the coast of Florida, and brought home the 190 dispirited Virginian colonists, with tobacco and potatoes. Early in 1587 he set sail with a strong squadron to cripple the king of Spain in his own seas, and retard his preparations for invasion—a sport which he called “singeing the king of Spain’s beard.” Sailing right into the harbor of Cadiz, he sank or burned as many as 33 ships, and made his way out unscathed. The seeming recklessness of his tactics was no devil-may-care bravado, but due to consummate seamanship no less than promptitude and courage. Drake next sailed to the Azores, capturing a rich homeward-bound Portuguese carack worth £100,000. In the face of the impending struggle for which Philip II. had long been preparing, his persistent plan was to follow up the policy of harassing the enemy on his own coasts—“to seek God’s enemies and her majesty’s where they may be found.”

Drake’s division in the three-fold arrangement of the English fleet was at first stationed off Ushant, until all the ships were blown together to Plymouth by the same storm that carried the Spaniards across the Bay of Biscay. Here, on the Hoe, the admirals and captains were playing the famous game of bowls, when the news was brought that the enemy was off the Lizard. Howard was eager to put to sea at once, but Drake would first finish the game, saying “there’s plenty of time to win this game, and to thrash the Spaniards too.” The story, whether true or no, is in perfect keeping with the character of the man. Early next morning the battle began, and raged along the Channel throughout the week. Drake’s consummate seamanship and audacious courage covered him with fresh glory, and inspired new terror in the Spaniards. On 29 July occurred the final action so disastrous to the Spaniards, after which they came to their fatal determination to return to Spain round the Orkneys. Two days later Drake wrote to Walsingham: “There was never anything pleased me better than the seeing the enemy flying with a southerly wind to the northward. God grant you have a good eye to the Duke of Parma, for with the grace of God, if we live, I doubt it not, but ere it be long so to handle the matter with the Duke of Sidonia, as he shall wish himself at Saint Mary Port among his orange trees.” It was not long before want of ammunition compelled Drake and Howard to fall back from the chase, but the storms of the northern seas took up their work and swept the Spaniards to destruction. Next spring a great expedition under him and Sir John Norreys sailed for the coasts of Spain and Portugal, but had little success beyond the damage inflicted upon the Spanish shipping, while sickness and actual hunger carried off thousands on board the crowded and ill-victualled ships. In August 1595, he sailed from Plymouth on his last expedition to the West Indies. Ill-fortune followed the fleet from the beginning: Hawkins, the second in command, died off Porto Rico in November, and Drake himself fell ill and died off Porto Bello. See the *Life* by Barrow (1843); Froude, ‘English Seamen of the 16th Century’ (1895);

Julian Corbett, short *Life* (1890); and his ‘Drake and the Rise of the Tudor Navy.’

**Drake, Francis Marion**, American capitalist and lawyer: b. Rushville, Ill., 30 Dec. 1830; d. Centreville, Ia., 20 Nov. 1903. In 1837 his family moved to Iowa, where he was educated. In 1852 he crossed the plains to California with ox-teams, encountering and defeating a band of Pawnee Indians on the route, and in 1854 crossed again with a drove of cattle. In 1855 he engaged in mercantile business in Drakeville, Ia., and in 1861 entered the army as a private. He served through the Civil War, attaining the rank of brigadier-general of volunteers. After the war he studied and practised law, and engaged in the railroad business, particularly the building of new roads. He was the first president of the Missouri, Iowa & Nebraska R.R., and was later president of the Albia & Centreville R.R. In 1880 he founded Drake University (q.v.) which he liberally endowed, and was president of the board of trustees till the time of his death. He was one term (1896-8) governor of the State of Iowa, being elected on the Republican ticket.

**Drake, Francis Samuel**, American historical writer: b. Northwood, N. H., 22 Feb. 1828; d. Washington, D. C., 22 Feb. 1885. He was a son of S. G. Drake (q.v.). He prepared a ‘Dictionary of American Biography’ (1872). He also published: ‘Life of Gen. Henry Knox’ (1873); ‘Tea Leaves’ (1884); and ‘Indian History for Young Folks’ (1885). Before his death he had gathered material for a new edition of his ‘Dictionary,’ which was incorporated in ‘Appleton’s Cyclopædia of American Biography.’

**Drake, Friedrich**, frēd’rīn drä’kē, German sculptor: b. Pyrmont, 23 June 1805; d. Berlin, 6 April 1882. Among his principal works are ‘The Eight Provinces of Prussia’ (colossal allegorical figures adorning a hall in the royal palace at Berlin), and a ‘Warrior crowned by Victory,’ which is reckoned one of the masterpieces of German sculpture.

**Drake, James Madison**, American journalist and soldier: b. Somerset County, N. J., 25 March 1837. He early engaged in newspaper work and served in the Union army throughout the Civil War, unfurling the first Union flag on Virginia soil 24 May 1861. After the war he settled in Elizabeth, N. J., and published there the *Daily Monitor* (1868-81), the ‘Sunday Leader’ (1882-7), and *Daily Leader* (1887-1900). He has written: ‘Fast and Loose in Dixie’ (1880); ‘Across the Continent in Red Breeches,’ etc.

**Drake, Joseph Rodman**, American poet: b. New York 7 Aug. 1795; d. there 21 Sept. 1820. He studied medicine, traveled in Europe, and after his return in 1819 contributed under the signature of “CROAKER” many pleasant and effective verses to the New York *Evening Post*. His friend Fitz-Greene Halleck joined him in this series, signing his own pieces at first “Croaker, Jr.,” but soon they both adopted the signature of “Croaker & Company.” The novelist Cooper was also one of the intimate associates of Drake and a conversation between them as to the poetical uses of American rivers, in the absence of historical associations, such as belong to the streams of the old world, was the occasion of Drake’s longest and most imaginative poem, the ‘Culprit Fay.’

## DRAKE — DRAMA

**Drake, Samuel Adams**, American journalist and writer; b. Boston, 20 Dec. 1833. He is a son of S. G. Drake (q.v.). He entered journalism in 1858. In 1861 joined the army and served throughout the War, becoming brigadier-general in 1863. He returned to Boston in 1871 and resumed literary work. His most important publications are: 'Old Landmarks of Boston' (1872); 'Around the Hub' (1881); 'New England Legends' (1883); 'New England Legends and Folk Lore' (1884); 'The Making of New England' (1886); 'The Pine Tree Coast' (1891); 'Our Colonial Homes' (1894); 'The Border Wars of New England' (1897); 'The Myths and Fables of To-day' (1900), etc.

**Drake, Samuel Gardner**, American antiquarian; b. Pittsfield, N. H., 11 Oct. 1798; d. Boston, Mass., 14 June 1875. He published 'Indian Biography' (1832); 'Book of the Indians' (1833); 'The History and Antiquities of Boston' (1856); 'History of the French and Indian War' (1870), etc.

**Drake University**, a coeducational institution in Des Moines, Ia.; founded in 1881, under auspices of Church of Christ. Named for Gen. Francis Marion Drake, its chief benefactor, whose gifts amounted to \$230,000, and who served as president of the board of trustees from the board's organization until his death, 20 Nov. 1903. Linked with the name of Drake as founder, is the name of D. R. Lucas, through whose influence the institution was located in Des Moines, and that of George Thomas Carpenter, its first chancellor and the moving spirit of the new enterprise. Total assets of the university, \$530,000. Available income about \$90,000 annually. There are eight organized colleges: Liberal arts, Bible, law, medicine, normal, conservatory of music, pharmacy, dentistry. Also eight special schools. Enrollment for year 1903-04 was 1,507. General control is vested in board of trustees, composed of (1) life members; (2) members elected by Iowa Christian Convention; (3) members elected by Alumni Association. President of the university, under direction of board, is head of the school.

**Drama**, a term taken from the Greek, literally signifying action, and applied to that form of literature intended primarily for presentation upon the theatrical stage. A production may be dramatic in form, and yet through lack of conformity, intentional or otherwise, to theatrical requirements, may belong to the class known as closet dramas. Dramatic literature during the greater part of its history has constituted one of the three great classes of poetry, epic and lyric verse being the other forms; but modern usage admits of prose as a vehicle of expression in the drama. The drama is commonly divided into two great branches, tragedy and comedy,—the former presenting the serious problems of human character and conduct, with deeds and circumstances trending toward a fatal issue; the latter depicting the bright and humorous side of life. Dramatic performances of some kind have been known probably among all nations, and seem generally to have been connected in their origin with religion. Compositions of a dramatic nature are found in the Old Testament, for example, in Job and the Song of Solomon.

**Oriental Drama**.—The forms of national drama developed in India and in China are

worthy of note among Oriental literatures. Chronologically they follow the drama of Greece, but lack the historic connection with modern drama, characteristic of the latter, and may be regarded independently. The Hindu drama, like the Greek, grew out of certain features of religious festivals, but contrasts strikingly with it in the lack of tragedy. The most famous specimen of Hindu dramatic literature is the 'Sakuntala' ('The Lost Ring') a seven-act drama by Kalidasa, the greatest of Hindu dramatists, and celebrates a romantic love episode. The date is uncertain, but the tendency of modern critics is to place the era of Kalidasa at least as late as the 4th century of the Christian Era. Another play by the same author is 'Vikramorvasi' ('The Hero and the Nymph'). In China the flourishing period of the drama appears to have been from the 13th to the 14th century. Chinese plays are very formal. They represent both humorous and heroic situations, but cannot strictly be divided into comedy and tragedy.

**Greek Drama**.—Incomparably the most interesting ancient dramatic literature is that of Greece, both for its intrinsic value and because of its relation to the drama of other European countries. At first the drama among the Greeks was by no means so distinctly separated from the epic and lyric poetry as we find it at a later period. Both forms, tragedy and comedy, took their rise in the celebrations of the festivals of the god Dionysus (Bacchus), at which hymns and chants were sung by choruses in honor of the deity; and the chorus continued to be a prominent feature of the old Greek drama. Tragedy is generally ascribed to Thespis about 530 B.C. No specimens of the earliest age of Greek drama, that is to say, of the compositions, either purely dithyrambic or consisting of choric songs interspersed only with monologue, which are supposed to have prevailed in the infancy of the art, now survive. The earliest examples, the dramas of Æschylus, whose chief predecessors were Phrynichus, Chœrilus, and Pratinas, exhibit the drama in a very advanced condition, so far as the particular style goes. Though in the earliest examples not more than two actors were permitted to be present as speakers on the stage at the same time, the dialogue is managed so as to unfold a varied and completely dramatic story; while the chorus, either as a whole or subdivided into sections, performs its lyrical odes, and, when necessary, takes part by its leader, and rarely by other members, in the spoken portions. The almost immediate addition of a third speaking actor, which, whether due to Æschylus himself or not, appears in his later plays, is practically the only change of importance subsequently made; and this was not as a rule further extended in Greek tragedy, that is to say, in the works of the three great writers, Æschylus, Sophocles, and Euripides. Very rarely the *quarta persona* or something like him appears, but this is a mere exception, and unimportant. The plays were for the most part, arranged in trilogies or sets of three, sometimes followed by a fourth play of a quite distinct and comic or satiric character. With each new play the restrictions of the unities were relaxed, or rather disappeared altogether, and a fresh time, a fresh place, and an only distantly connected scheme of action could be entered upon. These unities, which at various times have been the subject of sharp contro-

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versy, appear to be less *à priori* rules which the authors had before them than generalizations deduced and formulated from the practice of these authors. Some slight and some serious deviations from them have been observed, but on the whole they were rigidly observed. Generally speaking, the unity of time rules that not more than 24 hours are to be supposed to pass; the unity of place, that the scene shall not be changed; and the unity of action, that nothing like an independent underplot shall be permitted, every incident, and practically every speech, being subordinated to the main argument. When these strict conditions were taken with the exact and (in the case of the choruses) intricate metrical structure of the verse, they set Greek tragedy at the head of all literary performances as an example of exquisite symmetry of form, severe in its proportion. It is, however, almost as remarkable that, at least in Æschylus and Sophocles, no deficiency of dramatic interest attends this severity of form. Euripides is in this respect far inferior. Even in the earliest examples the metrical arrangements are consummate. The magnificent poetical quality of Æschylus, the sense of overmastering fate with which he manages to charge all his drama, and the perfect humanity of Sophocles, relieve their work entirely from the charge of sterility which has been brought against more modern imitations of their form. The subjects of Greek tragedy were limited to poetical and heroic tradition, with a certain admixture of what in modern literature we should call the chronicle-play, or drama of contemporary event. The extant example is the 'Persæ' of Æschylus; an exceedingly interesting play, because it shows the ease with which the Greeks could achieve what has baffled almost all moderns. Greek comedy is supposed to have commenced about 580-560 B.C. with Susarion, who is said to have traveled from place to place holding up to ridicule, on a small movable stage, the follies and vices of his age. By degrees the lyric element in comedy gave way to the dramatic, and the comic drama assumed the form familiar to us from the plays of Aristophanes (q.v.), whose 'Knights' appeared probably about 424 B.C. If it were not for the limitations of the female characters which Greek manners necessitated, Aristophanes would perhaps have been the equal of Shakespeare in comedy. As it is, he is unequalled in the class to which belong, with the play just mentioned, 'The Frogs' and 'The Clouds.' The old comedy of the Greeks was thoroughly national, with much of a political tendency. At the end of the Peloponnesian war (404 B.C.), Greek comedy received a new character and form, and "middle comedy," so called, began. It was strictly forbidden to bring living persons by name on the stage, and the chorus, till then the chief instrument of vituperation, was abolished; while, with the representation of general characters, corresponding masks were introduced, instead of those imitating the countenances of particular individuals. Even Aristophanes was obliged to submit to these regulations in his last plays. To the new comedy of the Greeks, which formed the next development, belongs Menander, 342-291 B.C., who by the keenness of his wit and the regularity of his pieces began a new period, the Greek comic drama. It may be said in general that Greek genius elaborated the stock comedy of certain general types of

character, so that in spite of great changes in manners, no original addition has since been made with the exception of what was contributed by Molière.

*Roman Drama.*—The Latin race, lacking the æsthetic temperament that distinguished the Greeks, accomplished little of importance in dramatic literature. The Romans as a people found more attraction in pantomimic shows and such spectacles as gladiatorial contests and the games of the circus than in the drama. The earliest specimens of the drama in Italy were the Atellan plays, so called from Atella, a city of the Oscans. These were farces or pieces in which broad buffoonery prevailed. The regular drama among the Romans was a mere imitation of that of the Greeks, Livius Andronicus, Ennius, and Pacuvius being the earliest writers of Roman tragedy. Plautus and Terence, a number of whose plays have come down to us, were imitators of the new Greek comedy. Their works have been the basis of many modern imitations or adaptations. The plays of Terence are distinctly literary works, probably following as closely as was feasible the Greek originals. The work of Plautus, although perhaps scarcely less indebted to Greek comedy for plots and incidents, displays a strong infusion of vernacular character with more of a distinctly Roman flavor to the humor. The fault of Terence's work is thinness; of that of Plautus, coarseness. Of Roman tragedy, the dramas attributed to Seneca are the only specimens extant. They are pretty obviously closet drama, that is, whether they were ever acted or not they were written as literature and not as playwright's work. Their importance lies in their influence upon the tragedy of the Renaissance. Italy and France felt that influence deeply, and if English taste had welcomed the innovation the stamp of Seneca would have been placed upon her literature also.

*Drama of the Middle Ages.*—The early Dark Ages produced nothing worth speaking of, while the Terentian comedies of the nun, Roswitha (q.v.), stand by themselves, and are little more than literary *pastiches*. Such dramatic entertainments as survived were attacked by the clergy as heathenish, immoral, and indecent exhibitions. When the drama reappears, it is connected as before with the offices of religion, though the precise extent to which this connection reached is a matter of much debate. About the 11th century in France appear the beginnings of the famous miracle or mystery play, which has sacred subjects only, is in its earliest forms very short, and consists for the most part in the representation "by personages," as the vernacular phrase went, either of scenes from the Bible or of legends of the saints. This kind of drama, which is still represented in a modified form by the famous Ammergau passion-play, was extremely popular; and though later in other countries than in France, has tolerably early representatives in most of them, especially in Germany and England. France, however, was its special home. As early as the 13th century a single French author, Adam de la Halle, originated, so far as is known, two important styles, the comic opera (in 'Robin et Marion') and the modern comedy, in the half autobiographic composition called the 'Jus' ('Jeu,' 'game') 'Adam' or 'Jus de la Feuillie' ('of the booth'). Of these compositions the former has hardly a trace of roughness, while the latter

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contains no hint of classical inspiration. By the 14th century France had added to the miracle or mystery, which branched out into the "profane mystery" or chronicle-play dealing with current events or ancient history, not merely the farce—the dramatization of the earlier verse *fabliau* or comic story, and the "morality"—an allegorical play of virtues, vices, and the life of man generally, to which the general mediæval passion for allegory gave great vogue; but also the *sotie* or political farce, as well as not a few minor varieties. The passion for dramatic entertainments was very great and societies or guilds existed for their performance.

*Italian Drama.*—Great as are the performances of Italy in European literature, her achievements in drama are of little moment, when compared with the towering fame of Dante and Petrarch, of Ariosto and Tasso. Her chief influence was to direct France into following the Senecan tragedy, and, through a writer who took the French name Larivey, but who was really a Giunti, the Terentian comedy somewhat relaxed. No Italian mediæval work for the stage is in the least remarkable; but as soon as the Renaissance dawned, certain writers, Trissino especially, adopted the stiff form of tragedy already referred to, the earliest noteworthy tragedy in Italian being his 'Sofonisba' (1515). Macchiavelli, Cardinal Bibbiena, and the great Ariosto, attempted comedy. The Italian pastoral drama sprang from the ancient idylls, and aimed at a fanciful delineation of Arcadian and mythological scenes. It gave birth to the lyrical drama, which under the name of opera, was from Italy to conquer Europe, and to push drama proper much out of favor. It was a little restored by a group of learned writers in the late 17th century, the chief of whom was the Marquis Maffei, a soldier, an antiquary, and a playwright, whose 'Merope' Voltaire followed very closely. Goldoni and Gozzi started the school of comedy which was to a great extent a reflection of national manners, and has real distinction. Whether as much can be said of the formal lyric dramas of Metastasio in the middle, or of the tragedies of Alfieri at the end of the 18th century, is perhaps a matter of taste. In spite of the high rank that has been accorded the latter, neither he nor any other writer of Italy has succeeded in drama, since the school of Venetian comedy, in striking what may be called an original note, though during the 19th century Manzoni and others attempted the style.

*Spanish Drama.*—In Spain, no mediæval performances of much merit are cited by historians; but instead of being diverted by the Renaissance into a mere following of classical models like France and Italy, the Spaniards showed independence almost equal to, and an immediate command of form far greater than, that of the English theatre itself. In part they continued the religious tradition by their *autos*, or sacred plays; in part they diverged into romantic drama of the freest kind; and they almost invented for themselves the comedy of fashionable life and intrigue which was imitated freely by all the great playwrights of the 17th century in other countries. They furnished in the 'Don Juan' (q.v.) story one of the most fertile dramatic motives of Europe, and in Lope de Vega and Calderon they produced dramatists not equaled in fertility anywhere, and surpassed in genius only by the greatest names of the world.

Half at least of the most famous plays of the French classical period are more or less directly borrowed from Spain, and England also pillaged in her turn. But the period of Spanish dramatic productiveness was unfortunately as short as it was brilliant; and it has had no revival. What the Spaniards did for Europe in dramatic matters was to develop a fertile and powerful drama in complete defiance of classical traditions, to show the dramatic possibilities of the supernatural, and to push almost to the farthest extent the comedy of ingenious surprises, and "wheels within wheels." Cervantes' tragedy of 'La Numancia' has fine qualities, and Moreto, a disciple of Calderon, in his day divided the favor of the public with the greater dramatists.

*French Drama.*—As has been noted, the passion for scenic representation as illustrated by the mediæval drama, developed in France earlier than in any other European country and the change to the dramatic form of the Renaissance was nowhere more marked. The first influence which led to the creation of the new drama came, as has been said, from, or rather through Italy. It is at first sight surprising that so vigorous and racy a kind as the indigenous comic drama of France had already shown itself to be, should be supplanted by a merely learned and literary importation. Nor in fact was it so, except in Paris and one or two other centres of culture, while even there it was not completely banished until the genius of Molière, which long exercised itself in something very like the ancient farce, effected a combination between the vernacular, the Terentian, and the Spanish comedy. In tragedy, however, the school commonly called the Pleiade—that is, the poet Ronsard and his set—effected a complete revolution, following the Senecan model. The two plays of Jodelle, 'Cléopâtre' and 'Didon,' set the example of a tragedy exactly resembling those attributed to Seneca. This style of tragedy was continued for many years, and was cultivated by Robert Garnier and Antoine de Montchrestien among others. In the hands of a later school, of whom Alexandre Hardy was the chief, a great infusion of Spanish romanticism took place. Yet the scheme of the tragedy was not much altered, whatever might be the case with the treatment, when Rotrou and Corneille at last formed the French classical tragedy proper. Whatever may have been the repressive influences exerted upon Corneille by the Academy the original strength of his great genius has made his name stand as that of a liberator of French thought and literary expression. It is of interest to note the presence in his 'Cid' of the Spanish influence. In his early work, Racine followed Rotrou, Corneille and Quinault, but in 'Andromaque,' he struck a new note which was brilliantly sustained. Comedy underwent a change less marked than that in tragedy. In this Scarron's share must not be overlooked. The great debt of the French drama was owing, however, to the three great masters, Corneille, Racine, and Molière (qq.v.). As produced by these men, and by imitators in the second half of the 17th century, both tragedy and comedy assumed shapes which France long retained unaltered, and which for a time gave law and pattern to all Europe except England, and even to some extent there. The tragedy was of the Senecan kind, with a slight relaxation of some of the minor stringencies,



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but with the unities for the most part maintained, and with, as a rule, the fortunes of a love affair substituted for the classic themes of fate and inherited doom. Comedy was less restricted. It might be written either in prose or in verse; the unities of place, and even to some extent of action, were neglected or construed loosely. A great variety of interest and subject matter was admitted, and the elaboration of really witty dialogue supplied endless opportunities of ornament. At the same time, in the hands of Molière nearly always, though less often in those of his followers, the moral or satirical purpose was carefully observed. The reign of these two kinds continued with little interruption till the end of the first quarter of the 19th century. In tragedy, Crébillon the elder succeeded in raising the style to something not far below Corneille's level, while Voltaire, applying his own singularly various and versatile talent to it, and enlarging the range of subject and situation, produced work which ranks as drama, though not as poetry, almost with the work of Corneille and Racine itself. In comedy, the level continued higher, very excellent work of the Molièresque kind, slightly altered in various ways, being done by Destouches, Marivaux, Piron, and others; while toward the middle of the 18th century, a sort of third or bastard kind, variously called as it approached one extremity or the other, *comédie larmoyante*, or *tragédie bourgeoise*, was introduced by La Chaussée, Sedaine, Diderot, and their contemporaries. Under the generic name of *drame* this may be said to have important representatives at the present day. It tended naturally to emancipate itself from the restrictions of tragedy, and so no doubt helped the great revolt of what is called the "romantic movement," which about 1830 practically destroyed the old French tragedy, and seriously interfered with the Molièresque tradition of comedy. The leader of the new school, Victor Hugo (q.v.), challenged the classicists by his "Hernani," which had the effect of literary dynamite. The alteration introduced a great amount of dramatic literature of much higher value than had been produced since the latter half of the 17th century. France once more became the central seat of drama in Europe, and foreign nations have freely adapted her productions. At the same time it must be confessed that tragedy proper has continually dwindled, and that even comedy of the higher kind has been somewhat injuriously affected. Among modern French dramatists may be noted Dumas, père (another leader of the romantic movement), De Musset, Augier, Scribe, Legouvè, Sardou, Dumas, fils; Coppée, Richépin and Rostand. The Belgian drama scarcely requires as yet to be treated independently of the French to which it has been considered an adjunct. Its most striking examples, the work of Maeterlinck, belong to the Parisian stage, representing there the new symbolism.

**German Drama.**—Of the great literary European nations, Germany has on the whole contributed least to the European drama, though one dramatic motive, the Faust story, is due to her, and though at two distinct periods, the middle of the 16th and the junction of the 18th and 19th centuries, the supernatural drama, of which this Faust legend has given the chief example, exercised, mainly through German impulse, great influence abroad. Otherwise the

Germans have been, save for one brief period, more remarkable for assiduous cultivation of the art of acting, and the theory of the stage, than for the production of great dramatic work. It was not till the middle of the 18th century that Lessing, not so much by his actual dramas as by his critical discussions of the drama and dramaturgy generally, earned for himself a really great place in dramatic history. At the end of that century what has been called the "Storm and Stress" school flooded Europe for a time with extravagant or sentimental productions of the class of which Schiller's "Robbers" and Kotzebue's "Menschenhass und Reue" ("The Stranger") are the most famous examples in two different kinds: while the first mentioned is perhaps the best, and the second one of the worst in literary merit. Kotzebue, indeed, was a very popular dramatist everywhere for a time. Schiller calming down from the state of mind out of which grew his "Robbers," produced a series of plays which to the Anglo-Saxon taste suffer from a too close approximation to the French style, while, according to classical standards, they err by dramatic license, but which nevertheless contain much noble poetry and some striking drama. In this same style Goethe's "Egmont" far surpasses anything of Schiller's, except the splendid chronicle-play of "Wallenstein," while his "Iphigenie in Tauris" is (if we disregard Milton's "Samson") the only modern classical drama which is really classical, and his "Faust" is not only one of the great works of European literature, but includes rather than constitutes some of the finest dramatic work to be found out of Shakespeare. Among the 19th century dramatists were Iffland, Körner, and the romanticist Tieck; and the 19th century has given among other minor dramatic works the plays of Hauptmann known as "dream-poems."

**Dutch Drama.**—Among the Dutch the drama began with the classical tragedies of Koster, known as the "Father of the Amsterdam theatre," and its highest point was reached by van den Vondel, the "Dutch Shakespeare." The national drama afterward reflected the change in French dramatic literature.

**Scandinavian Drama.**—In Denmark dramatic history begins with vernacular plays of the school-drama class extending through the 16th and 17th centuries. In Sweden, where such works held a nearly corresponding place, the plays of Messenius mark the beginning of national drama in the early part of the 17th century. The opening of the first Danish theatre in Copenhagen (1722) for which Holberg's comedies were written, marks the breaking away from French influence (till then dominant on the stage) which Wessel's "Love Without Stockings" aided in abolishing half a century later. Heiberg followed; then Ohlenschläger, a disciple of the German romantic school. In Sweden the revolt to romanticism came early in the 19th century. To late Scandinavian drama, Norway has contributed the works of Ibsen and Bjornson, dealing with social problems; the former's challenge to conservatism having won world-wide attention.

**English Drama.**—In England the drama was, except the German, the last to crystallize itself into a determined form, and while that form has on the whole maintained itself, various foreign influences have successively exercised



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more or less force there. In England, as elsewhere, the miracle-play existed, and divers collections of it, known as the York, Digby, Townley, Chester, and other collections, have been preserved and published. But these are both later and ruder than the French examples. Nor does the drama seem to have taken in mediæval England, until quite the beginning of the 16th century, anything like the various extensions which it received in France. From this period we have a sufficient variety—interludes, moralities, mysteries, the most important composer being John Heywood. The great and original school, commonly known as that of the Elizabethan dramatists, did not, however, arise till the last quarter of the century. Among the somewhat formless dramatic products which preceded it, without as far as can be seen giving this great group of playwrights much help of pattern or precept, it is usual and proper to distinguish three pieces—‘Ralph Roister Doister,’ by Nicholas Udall; ‘Gammer Gurton’s Needle,’ assigned to Bishop Still; and the tragedy of ‘Gorboduc,’ or ‘Ferrex and Porrex,’ by Sackville the poet and Thomas Norton. The first and second are comedies, or rather farces, the second of ruder type than the first, but both exhibiting a considerable advance from the mere interlude toward comedy proper. The third is after the style of Seneca—a style which, attempted also by Edwards, by Daniel, and by the Countess of Pembroke, was obstinately resisted by the English genius, and took no root. It is not possible to assign any foreign origin to that school of English drama, which, suddenly appearing in the work of the so-called “university” group, of Marlowe, Greene, Peele, and in a rather different vein, Lyly, passed into the far more capable hands of Shakespeare, Ben Jonson, Chapman, Dekker, Beaumont and Fletcher, Webster, Middleton, Thomas Heywood, Massinger, Ford, and Shirley. These were the master-dramatists of the world, and the so-called Elizabethan school closed with the death of Shirley (1666). At this time the two great ethical defects of the whole school, the unnecessary horror of its tragedy, and the unnecessary foulness of its comedy, had reached their highest point. When after the Restoration tragedy revived it assumed a different style. Partly influenced by the admiration of things French, but more by the fact that D’Avenant had been enabled by Oliver Cromwell’s love of music to introduce even during the Commonwealth a sort of musical drama, there came in what are called “heroic” plays, the chief formal characteristic of which is that they are written in rhymed couplets. These held the stage for about 20 years, their chief writer being Dryden, with Crowne, Otway, Lee, and others following him in tragedy, and Shadwell, Crowne, Otway, Etheredge, Wycherley, and others in comedy. At last Dryden himself returned to blank verse, and produced in it the last really fine examples of English tragedy, properly so called, for the work of Rowe and Congreve in this kind is not noteworthy. The licentiousness of the Restoration drama was a marked feature, and has hardly been equaled in any other European country. The 18th century produced nothing of value, and all the attempts that have been made since at pure tragedy on the English stage have been merely literary work, or a kind of *drame*, or performances of

scarcely any literary merit but of some stage adaptability.

No such fate for a long time befell comedy. Etheredge and Wycherley, the two chief writers of the new school, may be said to have adjusted the old humor comedy of Jonson, and the bustling lively comic work of Fletcher, to the change of manners, the greater demand for literary style, and the example of Molière. Following them, in the reign of William of Orange and that of Anne, Congreve, Vanbrugh, and Farquhar carried this altered style to almost its highest possible perfection. All their work was, however, marred by a singular brutality of thought, even in the rare cases where this was not coupled with an equal coarseness of language. For a long time the public demanded, enjoyed, or tolerated this; but at length taste changed, and the famous paper war, which had begun with Jeremy Collier’s attack on the stage, undoubtedly did much to purify English comedy. It did not strengthen it, and nothing in the way of comic dialogue has since been produced which equals the best scenes of Vanbrugh and Congreve. Much comic work of merit was produced, until the time of Goldsmith. His two masterpieces were followed at no very great interval by the famous work of Sheridan, in which the methods of what may still be called Restoration comedy are adapted to altered tastes in literature and morals with surpassing skill. Sheridan is the last great name in the English drama. With rare intervals the works of Shakespeare have kept the stage; but all the other old tragic dramatists have become obsolete, and, excepting Goldsmith and Sheridan, the old comic writers have shared the same fate. Successive schools of dramatic writing have had their day of favor, sometimes owing to the predilections of certain popular actors. The most important, probably, of strictly 19th century English playwrights was Lord Lytton. Yet the ‘Lady of Lyons,’ ‘Money,’ ‘Richelieu,’ etc., though usually effective on the stage, can scarcely be said to be so to the reader, while on the other hand, the dramatic works of Byron, Coleridge and Taylor, of Tennyson, Browning, Landor, Horne, and Swinburne, belong to closet drama.

Among the minor dramatists whose work, even if in some cases very ephemeral, is at least prominent for successful acting qualities—may be named Jerrold, Brooks, Tom Taylor, J. W. Marston, Wills, Robertson, H. J. Byron, Boucicault, Grundy, H. A. Jones, A. W. Pinero, Chambers and Stephen Phillips.

Of the drama of other European countries it may be remarked that they have not shown even in the period of freeing themselves from the domination of the classic French school and responding to the romantic movement, such originality or brilliance as compels the world to lend an ear. To Russia, where Pushkin, Griboyedoff, and Ostrovski, have done work of importance, or at least of interest, we may look for a future drama that stands on a level with her school of fiction.

*American Drama.*—The history of the drama in the United States has more to do with players than with plays, for the work of American dramatists has been of small value, lacking in originality, in large themes and in literary construction. We have no dramatist worthy of the name; rather we have a school of brilliant

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translators, imitators and adapters. Early stage productions were of English plays and not until 1787 was an American play by an American author produced. This was 'The Contrast,' written by Royall Tyler, afterward chief justice of Vermont, and can be very briefly described as a patriotic trifle. The first prolific American dramatist, William Dunlap, flourished from 1798 to 1815, with half a hundred plays to his credit. Not until 1820, when Edmund Kean visited this country did the people look with favor upon the drama. When Edwin Forrest made his appearance in New York in 1826, he produced two tragedies by native writers, 'Metamora,' by John A. Stone, and 'The Gladiator,' by R. N. Bird. Dion Boucicault, who wrote 'Rip Van Winkle,' and other English actors, who were also playwrights, made American tours and remained here to stimulate the drama, but until the close of the Civil War, the American stage was dependent upon England for her plays, her players, and her playwrights. Augustin Daly was among the first to encourage the American playwright. He maintained a company of superior players and was in hearty sympathy with a purely American drama.

The nearest approach to a purely American drama had its inception in the work of Bartley Campbell (b. 1843; d. 1888). He produced 'My Partner,' a western melodrama, in New York, in 1879, with remarkable success. This was followed by 'Fairfax' and 'The Galley Slave,' and later by 'Matrimony,' 'The White Slave,' 'Siberia,' and 'Paquita.' Several of his plays were produced in England with the same success that had been accorded them in this country. Bronson Howard, a contemporary of Campbell, was the author of a dramatic composition called 'Fantine,' which was played in Detroit as early as 1864. His first important play, 'Saratoga,' was produced by Augustin Daly in 1870. Other plays by Mr. Howard gave him a foremost position among American playwrights. His best-known plays were 'The Banker's Daughter' (1878); 'Old Love Letters' (1878); 'Young Mrs. Winthrop' (1872); 'One of Our Girls' (1885); 'The Henrietta' (1887); 'Shenandoah' (1889); 'Aristocracy' (1892). Several of these plays were produced in London, and 'Saratoga' was played in Berlin by Paul Lindau. A third American among the earlier successful playwrights was Henry C. DeMille (1850-93). Augustine Daly was also a successful playwright. His first play, 'Delmar's Daughter,' was produced in 1883. Then followed 'The Main Line,' 'Lord Chumley,' 'The Charity Ball,' and 'Men and Women.' 'The Wife' was written in collaboration with David Belasco, and was played at the Lyceum theatre (1887). Other American playwrights who have won distinction include David Paul Brown, Augustus Thomas, who wrote 'Arizona' and 'Alabama'; William Gillette, author of 'The Private Secretary,' George H. Baker, Epes Sargent, Henry Guy Carleton, Charles H. Hoyt, Madeleine Lucette Ryley, David Belasco and Clyde Fitch.

A phase of the drama in America is the adaptation of the historical novel, which had its genesis in the stage production of 'Uncle Tom's Cabin.' The so-called rural plays, like Denman Thompson's 'Old Homestead,' are thoroughly national in plot and character and have met with phenomenal financial success,

despite the fact that as literary productions they are invariably defective. At the present writing the drama in this country is at the lowest possible ebb; a popular craze for burlesque, light comedy and vaudeville having occupied the almost undivided attention of manager, actor, and playwright.

*Summary.*—A survey of the great body of dramatic literature will lead to the conclusion that not merely the forms which literary work for dramatic representation can take, but even the situations and incidents which are suitable to such representation, are by no means very numerous, and tend to reproduce themselves in the practice of different times and different nations with considerable regularity. We also see that considerably less variety is obtainable in tragedy than in comedy, and that the former is infinitely the more difficult. The ages and circumstances in which drama has flourished most, have been those in which it occupied for a time and sometimes almost monopolized the position of public instructor and informer on questions of thought and news, as well as that of public entertainer. Another point worth noting is that the periods of best acting have by no means always coincided with the periods of best drama writing. Shakespeare's plays, in continuing to hold their own upon the stage, have trained great actors without producing great dramatists. See ACT; CHORUS; COMEDY; FARCE; THEATRES, AMERICAN; MIRACLE PLAYS AND MYSTERIES; PLAYWRIGHT; SHAKESPEARE; STAGE, THE.

*Bibliography.*—Archer, 'English Dramatists of Today'; Collier, 'History of English Dramatic Poetry'; Crawford, 'English Comic Dramatists'; Freytag, 'The Technique of the Drama'; Hazlitt, 'English Comic Writers'; Klein, 'Geschichte des Dramas' (Leipsic, 1865-86); Lamb, 'Essays' (Dramatic); Lowell, 'The Old English Dramatists'; Matthews, 'The Development of the French Drama'; Moulton, 'The Ancient Classical Drama'; Patin, 'Etudes sur les tragiques grecs' (Paris, 1885-94); Prölss, 'Geschichte des neueren Dramas' (Leipsic, 1880-3); Price, 'The Technique of the Drama'; Scott, 'The Drama of Yesterday and To-day' (1889); Schaeffer, 'Geschichte des Spanischen Nationaldramas'; Schlegel, 'Vorlesungen über dramatische Kunst und Litteratur'; Symonds, 'Shakespeare's Predecessors in the English Drama'; Tieck, 'Dramaturgische Blätter'; Ward, 'English Dramatic Literature.'

WILL M. CLEMENS,

Editorial Staff, 'Encyclopedia Americana.'

**Dramatic Arts, American Academy of,** a school of dramatic arts, chartered by the regents of the state of New York, in 1889. Its object is to train pupils for the stage. It offers a two years' course, including opportunities for public appearances. The school was established by Franklin Sargent (q.v.).

**Drammen, drām'mēn,** Norway, a seaport at the mouth of the Drammen River, on an arm of the Christiania Fjord, 25 miles southwest of Christiania. It is the second port in the kingdom for the export of timber. Pop. 20,441.

**Dranesville, Battle of.** Dranesville is on the Alexandria and Leesburg turnpike, 16 miles northeast of Washington; and 20 Dec. 1861, to collect a supply of forage near there, Gen. E. O. C. Ord, with his brigade of Pennsylvania

Reserves, the First Pennsylvania Rifles, a battery of four guns, and a detachment of cavalry—in all about 3,900 men,—moved from camp near Langley's. Driving a few Confederate cavalry from Dranesville, he entered it. It happened that the same morning Gen. J. E. B. Stuart started from the Confederate lines at Centreville with a brigade of infantry, 150 cavalry, four guns, and about 300 wagons, to gather hay near Dranesville; and he was so engaged when he heard that Ord was approaching. Fearing for the safety of his train, and believing that the only way to save it was to attack Ord, he advanced for that purpose, at the same time ordering his wagons back to Centreville. Stuart attacked with great impetuosity, and after a severe fight of two hours was defeated and retreated to Centreville, with a loss of 186 killed and wounded. Ord's loss was 67 killed and wounded. Compared with subsequent events, Dranesville was a small affair, but it gave encouragement to the Union cause and stands greatly to the credit of the Pennsylvania Reserves. Consult: 'Official Records,' Vol. V.

E. A. CARMAN.

**Draper, Andrew Sloan**, American educator: b. Westford, N. Y., 21 June 1848. He served in the New York legislature; was appointed by President Arthur one of the judges of the court of Alabama claims; was State superintendent of public instruction in New York in 1866-92, superintendent of schools in Cleveland, Ohio, in 1892-4; and in 1894 became president of the University of Illinois. In 1904 became state superintendent of schools, New York. He has published: 'American Schools and American Citizenship'; 'American Universities and the National Life'; 'The Rescue of Cuba,' etc.

**Draper, Daniel**, American meteorologist: b. New York 2 April 1841. He studied science under his father, J. W. Draper (q.v.), acting as his assistant and amanuensis for years. After 1869 he was director of the New York Meteorological Observatory, the self-recording instruments in use there being of his design.

**Draper, Henry**, American scientist: b. Prince Edward County, Va., 7 March 1837; d. New York 20 Nov. 1882. He is a son of J. W. Draper (q.v.). He was well known for his work in the line of celestial photography, and published 'A Text-book on Chemistry' (1866).

**Draper, John Christopher**, American physician: b. Prince Edward County, Va., 31 March 1835; d. New York 20 Dec. 1885. He was graduated from the medical department of New York University; was professor of physiology in that institution 1858-60, and professor of chemistry in the medical department 1866-85. He was also professor of chemistry at Cooper Union, and professor of physiology and natural history at the College of the City of New York. He wrote: 'On Respiration' (1856); 'Text-book on Anatomy, Physiology and Hygiene' (1866); 'Practical Laboratory Course in Medical Chemistry' (1882); 'Text-Book of Medical Physics' (1885).

**Draper, John William**, American physiologist and chemist: b. Saint Helens, Lancashire, England, 5 May 1811; d. Hastings-on-the-Hudson, N. Y., 4 Jan. 1882. He came to the United States in 1833, and took his degree as M.D. at the University of Pennsylvania in 1836. He be-

came professor of chemistry in the University of New York in 1841, and in 1850 professor of physiology. Among his works are: 'Human Physiology' (1856); 'History of the Intellectual Development of Europe' (1862), a work of great importance and very widely read; 'History of the American Civil War' (1867-70); 'History of the Conflict between Religion and Science' (1875), which ran through many editions and was translated into nearly all the languages of Europe.

**Draper, Lyman Copeland**, American antiquarian: b. Hamburg, N. Y., 4 Sept. 1815; d. Madison, Wis., 26 Aug. 1891. He removed to Wisconsin in 1853; became corresponding secretary of the State Historical Society, and it was mainly through his efforts that the State secured its library and its important antiquarian collection. He published: 'Collections' of the State Historical Society (10 vols. 1853-87); 'Madison the Capital of Wisconsin and its Heroes' (1857); 'King's Mountain and its Heroes' (1881).

**Draper, William Franklin**, American manufacturer; b. Lowell, Mass., 9 April 1842. He was educated in the public schools and at a private academy, served in the Federal army through the Civil War, becoming brigadier-general by brevet. He became a successful manufacturer of cotton machinery and made and patented many improvements in it. He was a presidential elector in 1888; a Republican member of Congress 1892-7; and United States ambassador to Italy 1897-9. While in Congress he was a member of the Committee on Patents and the Committee on Foreign Affairs.

**Drapery.** See COSTUME.

**Drapier Letters**, a series of letters published by Dean Swift (q.v.), over the signature M. B. DRAPIER in 1724. They were called out by the proposal to impose upon Ireland a debased coinage, from which a court favorite and a king's ministers were to get the profit. The opposition to the action excited by these letters defeated the project and gave Swift a reputation he never lost. See also SWIFT, JONATHAN.

**Draughts.** See CHECKERS.

**Drave**, drä'vê, or **Drau**, a European river which rises in Tyrol, flows east-southeast, part of its course between Hungary on the left and Croatia and Slavonia on the right, and after a course of nearly 400 miles joins the Danube 14 miles east of Essek. It is navigable for about 200 miles.

**Dravid'ian**, a term applied to the people who inhabited the southern part of what is now India previous to the advent of the Aryans, and also to the language spoken by these same people. The Dravidian languages are generally considered to belong to the Turanian class—a family of languages said by some authorities to include all the Asiatic languages in general, outside the European and Semitic families. The Dravidian languages include the Tamil, Telugu, Canarese, Malayâlam, Tulu, Tuda, Gond, Rajmahal, and Oraon. There are other minor subdivisions made by some authorities. Only the first four mentioned have a literature. The Dravidians now occupy the greater part of the peninsula of India. The Tudas, or Todas, in the region of the Nilgiri Hills, belong to the lowest of civilized people or races, while among

the Tamils are found many who have attained a high place in literature.

The Dravidians proper are quite distinct from the Aryans, but they have been assimilating with those around them, so that now among them may be found traces of the Caucasians, and their literature partakes much of the Aryan culture; but they have kept their speech comparatively pure for centuries. In the southeastern part of the peninsula and in Ceylon live those who speak the Tamil; estimated to be about 16,500,000 people. North of the Tamils, and on the east, are the Telugus, about the same in number. The Canarese is spoken by about 10,000,000 people who live in the western part of the peninsula; and the Malayalam by about 4,230,000 people who live in the southwestern part of the peninsula.

In the Tamil and Telugu languages there are a number of excellent literary productions; not all original, some are modeled on or adapted from the Sanskrit. Two of the poems which may be traced to at least the 10th century—but which the Tamils claim are much older—are the 'Kintamani' and the 'Naladiyar.' The latter has been translated by Pope. The Tamils claim also that Agastya lived before Christ, and that he was the first teacher of science and literature. In about the 12th century, the poet Kambar made, in Tamil, an adaptation of the Sanskrit poem 'Ramayana,' one of the two great epics of India; and in the 16th century the poet Ati-Vira-Rama Pandya, a native king, wrote works of merit. The Tamil poet Tayumanavar wrote in the beginning of the 18th century; and at about the same time, an Italian missionary, a Jesuit named Beschi, wrote in the Tamil, both prose and poetry. The work of this literary priest has done much toward directing the attention of eastern scholars to the Tamil language and literature.

The oldest poem extant in Telugu language is a version of the Sanskrit poem, the 'Mahabharata,' the other of the two great epic poems of India. This poem was written in the Telugu by Nannaya Bhatta, in the 12th century. A poet named Cesava of the 12th century wrote in the Canarese. In the Malayalam there is one poem based upon the Sanskrit, an account of Rama, a heroic prince who belonged to a royal house of India. There are also versions of both the 'Mahabharata' and the 'Ramayana.' Consult: Dalton, 'Descriptive Ethnology of Bengal'; Kingcote, 'Folk-Lore of Southern India'; Caldwell, 'Comparative Grammar of Dravidian'; Oppert, 'Original Inhabitants of India'; Hunter, 'Dictionary of the Non-Aryan Languages'; Pope, 'First Lessons in Tamil'; Graul, 'Tiruvalluvar's Kural'; Hultzsch, 'South Indian Inscriptions, Tamil and Sanskrit'; Arden, 'Grammar of the Telugu Language'; Brown, 'Dictionary of Telugu'; Hopkins, 'Great Epic of India'; Fraser, 'Literary History of India'; Carr, 'Collection of Telugu Proverbs.'

**Draw-loom.** See DAMASK WEAVING.

**Drawback,** in common law, means an allowance or rebate made by the United States government to merchants on the re-exportation of certain imported goods, liable to duty. This drawback in some cases consists in the surrender of the whole duties collected on the goods; in other cases, only a part of the duties paid on the importation is returned to the importer.

**Drawbridge,** a bridge with a lifting or sliding floor, such as may be used for crossing the ditches of fortresses or may be constructed to cross navigable waters where the height of the roadway is insufficient to allow vessels to pass underneath. There are various kinds of drawbridges. One is the lifting bridge, which is raised bodily on one end. For fortifications this is the kind commonly employed, the platform forming or strengthening the gate when raised. For detailed history see *Movable Bridges* under BRIDGE.

**Drawing** is the art of representing upon a flat surface the forms of objects, and their positions and relations to each other. The idea of nearness or distance is given by the aid of perspective and foreshortening. Two ancient Greeks, Ardices and Telephanes, are said to have been the first who attempted to give the idea of roundness by a combination of lines called hatching. Philocles and Cleantes were the inventors of monochromes, or drawings in one color, in which the lighter parts were produced by mixing the color with white. This formed the transition from drawing to painting. The Greeks were very strict and precise in their teaching of drawing. Pamphilus, the teacher of Apelles, desired that his pupils should remain 10 years with him receiving instruction. Linear drawing was brought in Greece to the highest degree of perfection. The contest between Apelles and Protogenes as to which of them could draw lines with the greatest delicacy and precision is well known.

The term drawing, in its strict sense, is only applicable to the representing of the forms of objects in outline, with the shading necessary to develop roundness or modeling. Pictures in oil or water colors, though based on drawing, should be exclusively called paintings. This distinction is observed in what follows.

The various styles of drawing may be divided into three kinds: (1) pen drawings; (2) chalk drawings, which may include lead-pencil drawing; (3) drawings shaded with the brush or hair-pencil. Pen drawings are often confined to pure outlines; an appearance of relief or projection being given by thickening the lines on the shadow side. Finished pen drawings have all the shading produced by a combination of lines termed hatching. Small, fine-pointed brushes are now often used instead of the pen, more delicacy and variety of tone being obtained. Drawings shaded with the brush are outlined with the pen, the shading being laid on or washed in with the brush in tints of Indian ink, sepia, or bistre. This method is used chiefly for architectural drawings and historical sketches. Chalk drawings are most suited for beginners, as the errors can be easily corrected. Black, red, and white chalks are used. When the chalk is powdered and rubbed in with a stump, large masses and broad effects can be produced with much rapidity.

Drawings may be divided into five classes: sketches, finished drawings, studies, academic drawings, and cartoons. First sketches are the ideas put upon paper by an artist, with the intention of carrying them out with more completeness and detail in some more elaborate work. They are merely intended to fix and retain his first thoughts. Finished drawings are such as are carefully executed and made complete in all

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their parts. By studies are generally understood separate parts of objects carefully drawn either from life or from figures in relief; for example, heads, hands, feet, arms; but sometimes the term is applied to drawings of entire figures. To this class also belong drawings of the skeleton and muscles, as well as of draperies, animals, trees, foregrounds or other parts of landscapes. Academic drawings are those made in art academies from a living model in lamplight, which brings out the shadows more than daylight. The position of the person who serves as a model is carefully arranged at the commencement of each sitting, and in that position he is required to maintain himself. In this way the learners practise themselves in the drawing of the figure in various attitudes. In studying drapery and dress, a lay figure, made of wood and with movable joints, is clothed in various styles, and drawings made from it. Cartoons are drawings made on stout paper of the size of the paintings to be executed from them. They are mostly employed for pictures of large size, and are regularly used by fresco painters. The design is pricked through or traced from the cartoon upon the surface that is to receive the finished picture. See CAR-TOON.

The first sketches of the great masters are especially prized, because in them we find expressed most clearly the first glow of their conceptions. It is therefore much more difficult to make a copy of a first sketch with such accuracy as to deceive, than it is to make such a copy of a finished picture, for in the former case so much depends upon the freedom and facility with which the idea is expressed. The great schools of painting differ from one another as much in their drawing as in their painting. In Italy the Roman school, through Raphael's fine sense for the beautiful and expressive in form, and through his study of the antique, became the true teacher of beautiful drawing. The Florentine school tried to surpass the Roman precisely in this particular, but it lost by exaggeration what it had gained by learning and a close study of anatomy. In the Lombard school a tender style of drawing is seen through harmonious coloring, but this is rather derived from nature and instinctive feeling than attained by a close obedience to scientific principles. In the Venetian school the drawing is often veiled in the richness of the coloring, and if in some of the Venetian masters the drawing is bold and powerful, it indicates no deeper sense, no elevation or dignity, and is only imposing by its fearlessness and luxuriant fulness. The Dutch school excels in a careful and minute style of naturalistic drawing, combined with great excellence in coloring. The French school in the time of Pous- sin was very correct in its drawing; at a later period its style betrayed a great amount of mannerism. David introduced again a purer taste in drawing and a close study of the antique, and these are qualities which distinguish his school (the so-called classical school) from the romantic school of a later period, and the eclectic school of the present day, whose drawing is characterized by less dignity and grace, but shows more individuality and character. The modern German masters have a different style, which has been formed by an independent study of nature, and of the great masters, modified by the idiosyncrasies of the German mind. The drawing of the British school is naturalistic rather

than academic. It has of late years much improved in accuracy and expressiveness. The American school is similar to that of France, the artist being given to mannerisms, as evidenced in the work of Gibson, Taylor, Meyer, and others.

The best mode of acquiring the art of drawing is to commence by the simplest geometrical lines, proceeding to geometrical figures, from the more simple to the more complex. The student should first practise drawing accurately—perpendicular, horizontal, oblique, curved, and waved lines; then he should draw squares, triangles, circles, and ovals. These forms are the best for early instruction, because from their simplicity any inaccuracy in their delineation is easily detected. When the learner has conquered the difficulty of drawing these forms with accuracy he should proceed to draw those of a more arbitrary kind, such as the scroll and cylinder; then pyramids, obelisks, or vases, cups, books, baskets, etc., by which he will gradually become possessed of a more correct vision, and be able to give a proper degree of grace to his curved lines.

Having acquired a sufficient facility in drawing and shading these simple forms, he ought next to proceed to drawing from copies outlines of antique busts and statues. Such subjects are well calculated to give correctness to the eye, as from their beauty and perfection any slight deviation from their just proportions instantly offends and is easily detected. On the other hand, when landscapes and flowers are used as copies, an error in drawing the irregular forms that occur in them is much less easily perceived, the student is apt to be too easily satisfied with his work, and to fall into negligent habits which cannot afterward be easily eradicated. All these drawings should be made on a large scale, and be executed in a bold, distinct, and what painters call a broad style. Thus all the separate features of the face should be drawn the full size of life; for next to drawing from bad examples, nothing is a greater hindrance to proficiency than the making of small and miniature drawings.

In beginning a drawing, first get the object or objects into proper position on the paper, next into proper size, and last into proper shape. By inverting this mode of procedure learners frequently render their work very irksome, and are mortified to find that when they have matured a portion of their drawing, the part is not truly in position, or not of the proper size. The learner's first care should be accuracy of outline; next a studious observation of the shading and shadows that give roundness and relief to objects, combined with an earnest aiming at perfect manipulation. These being mastered, boldness of touch and rapidity of execution will follow.

Chalk-drawings are generally executed on a colored paper, for the purpose of producing a middle tint, so that a drawing on gray or stone-colored paper will have three degrees or tones of color—two from the chalks and one from the paper. Charcoal is used to sketch in the outline, which is then matured and made correct with Italian or hard black chalk. The shadows are laid in freely and broadly with soft black French chalk, and then softened and blended together with a stump. Chalk has many advantages over black-lead pencil; more especially



## DRAWING AND QUARTERING — DREAMS

it is suited for drawings of large size, and it is by practising on a large scale that freedom and accuracy of hand are mainly to be acquired.

Before attempting to make sketches of landscapes from nature, the student ought to be pretty well acquainted with the general rules of perspective. He may then sketch whatever pleases him, commencing with the foreground and nearest objects, and from them comparing the size and relative positions of the more distant; for instance, if a wall or building come into the foreground of the sketch, from it he may find the position of a more distant object, such as a church, by comparing horizontally what part of the wall the church is opposite, and so on, for the retiring distance.

*Literature.*—Cross, 'Color Study'; Hamerton, 'Drawing and Engraving'; Hutchinson, 'Some Hints on Learning to Draw' (1893); Leland, 'Drawing and Designing'; Maginnis, 'Pen Drawing' (1900); Ruskin, 'Elements of Drawing'; Spiers, 'Architectural Drawing'; Veollet, 'Learning to Draw'; Walker, 'Hand-book of Drawing'; White, 'Drawing for Reproduction'; Wilson, 'Free-hand Perspective.'

**Drawing and Quartering**, the punishment of treason in Great Britain in force till 1870. The law provided that the offender be drawn to the place of execution on a hurdle; that he be hanged by the neck and disemboweled; that his head be severed from his body, and that body be divided into four parts, or quartered.

**Drawing-board**, a board on which paper is strained for water-color painting. It is made of a flat piece of wood held together and prevented from warping by an edging of other pieces, the grain of which runs in an opposite direction. The drawing-paper is first damped and then attached to the edges of the board with thin glue, gum, or paste, and when dry becomes perfectly tight and flat.

**Drayton, Michael**, English poet: b. Harts-hill, Warwickshire, 1563; d. London 1631. His first appearance as an author was in 1591, by the publication of 'Harmony of the Church, Containing the Spiritual Songs and Holy Hymns of Godly Men, etc.,' followed in 1593 by 'Idea, the Shepherd's Garland,' and 'Roland's Sacrifice to the Nine Muses,' a series of eclogues. In the same year appeared his 'Legend of Piers Gaveston,' and in 1594 his 'Matilda.' Drayton's great poem is his 'Polyolbion' (1613), a sort of topographical description of England. It is generally extremely accurate in its details, with, at the same time, many passages of true poetic fire and beauty. It is frequently, however, tedious and obscure, and its extreme length is sufficient to deter many from undertaking its perusal. The gem of Drayton's poems is his 'Nymphidia, the Court of Fairy,' edited by Sir E. Brydges in 1814. His other works comprise several historical poems, such as the 'Barons' Wars' (1603, first issued in 1596 under the title 'Mortimeriados'); 'England's Heroical Epistles' (1597); the 'Legend of Great Cromwell' (1607); the 'Battle of Agincourt' (1627); besides numerous legends, sonnets, and other pieces. He was buried in Westminster Abbey, where there is a monument to his memory.

**Drayton, Thomas Fenwick**, American military officer: b. South Carolina about 1807; d. Florence, S. C., 18 Feb. 1891. He was graduated at the United States Military Academy

in 1828, and resigned from the army in 1836. He entered the Confederate army upon the outbreak of the Civil War, and played a prominent part during the attack on Fort Royal, commanding a force in Fort Walker which he was forced to evacuate.

**Drayton, William, LL.D.**, American judge: b. South Carolina 1733; d. June 1790. He was educated for the bar in the Middle Temple, London, where he studied four years. He returned to America in 1754, and was appointed chief justice in the province of East Florida in 1768. During the War of the Revolution he was suspended from his office and reinstated in it, and went with his family for a time to England. After the Peace he became successively judge of the admiralty court of South Carolina, associate justice of the State, and a judge under the Federal government.

**Drayton, William**, American politician: b. South Carolina; d. Philadelphia 24 May 1846. He was a representative in Congress from South Carolina from 1825-33, and in 1830 was a leader of the Union party in opposition to that of nullification. He resided in Philadelphia many years prior to his death, and in 1839 succeeded Nicholas Biddle as president of the United States bank, the affairs of which he found it impossible to retrieve.

**Drayton, William Henry**, American statesman: b. Drayton Hall, S. C., September 1742; d. Philadelphia 3 Sept. 1779. He was educated in England at Westminster School, and at Balliol College, Oxford. Returning to America in 1764, he became an active writer on political affairs, and published letters on the side of the government, which brought him into controversy with Christopher Gadsden and other patriotic leaders. As the Revolutionary crisis approached he espoused the popular cause. In 1774 he was appointed judge of the province, and when the Continental Congress was about to sit he published a pamphlet under the signature of "A Freeman," which substantially marked out the line of conduct pursued by the Congress. In 1775 he was president of the Provincial Congress, and in 1776 was elected chief justice of South Carolina. He was a member of the Continental Congress from 1778 till his death. His 'History of the Revolution' appeared in 1821.

**Dreams**, subjective phenomena dependent on natural causes, or trains of ideas which present themselves to the mind during sleep. The principal feature of the state of dreaming is the absence of voluntary control over the current of thought, so that the principle of suggestion has unlimited sway. The utter want of coherency in the images that appear before the mental eye excites no surprise in the dreamer. All reflex acts are lowered; breathing and the action of the heart become slower, and the other organic functions are diminished. These phenomena are due to the exhaustion of the energy of the brain, and to the changes necessary for its restoration, and for the removal of tissue waste. They are accompanied by a diminution of the amount of blood flowing through the brain. As we go to sleep our senses drop off one by one; we cease to see or smell, while we still continue to hear. A light sleeper may, without waking, answer questions put to him, and we may sometimes go so far as to deliver an oration or pen a treatise, which, in our wak-



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ing remembrance, may often seem much more clearly and vigorously thought out than if we had composed them by the efforts of the will during waking hours.

Cabanis, in his '*Rapports du Physique et du Moral de l'Homme*,' says of Condillac, that he often brought to a conclusion in his dreams reasonings on which he had been employed during the day, and which he had not completed when he went to bed; and of Franklin, that that wise and enlightened man believed that he had been often instructed in his dreams concerning the issue of events which at that time occupied his mind.

Coleridge thus describes the circumstances under which the fragment called *Kubla Khan* was composed: He had fallen asleep in his chair while reading in Purchas' '*Pilgrimage*' of a palace built by Khan Kubla, and remained in that state for about three hours; during which he could not have composed less than from 200 to 300 lines, if that can be called composition in which all the images rose up before him as things, with a parallel production of the correspondent expressions, without any sensation or consciousness of effort. On awaking he instantly sat down to commit the poem to paper. After he had written the lines subsequently published, he was interrupted for a time, and when he returned to the task the poem had vanished from his memory. The cause of this coherency no doubt is, that when we are awake the attention is more liable to be withdrawn from the train of ideas by external objects.

Generally, however, dreams are wanting in coherency; all probabilities and possibilities of time, place, and circumstance are violated. Nothing is more common than for the mind in dreams to combine objects and events which could have had no associated existence. The faces of friends long since dead, and events long since past rise before us sometimes with more intense vividness than in real existence and cause no surprise by their incongruity, because the mind views them without the association of ideas which, in a waking state, would place them at such a distance from the present time that no cognizance could be taken of them except as very remote events. It is the belief we for the time possess that these trains of ideas are sensations that removes all sense of surprise and incongruity; we have not, together with these apparent sensations, the ideas of the death or the period elapsed, and we are not surprised at seeing, or believing that we see, the persons or events, any more than we would be surprised at seeing, if that were possible, the same persons or events when we are awake, if we did not know that the person had died or that the event was historical. This explanation is confirmed by those instances in which we do feel surprise. The idea of a person or event believed to be seen may call up any of the additional ideas that have before been absent. We fancy we see a person, and then we think of his death; we are immediately surprised, and we have an inner dream that we are dreaming.

Sensations of physical pain, including those of heat and cold, and sensations in the alimentary canal, have an important influence on dreams. Dr. Gregory relates, that having occasion to apply a bottle of hot water to his feet on retiring to bed, he dreamed of making the ascent of Mount Etna and found the heat intolerable. Dr.

Reid having had a blister applied to his head dreamed of being scalped by Indians. One notable peculiarity is that when the physical sensation influences the dream, the intensity of it, pleasurable or painful, is considerably increased. Thus if the ear be disturbed by the sounds of a flute, a thousand beautiful and pleasing associations may be invoked; the air is filled with the sounds of harps, or the combined intricate harmonies of a concerted and accompanied piece, and we may call up images of the performers themselves.

The rapidity with which we dream is also remarkable. We may seem to live a weary lifetime in the dream of a minute; the sprinkling of a few drops of water on a gentleman's face produced a dream in which the events of a whole life passed before him, ending with a protracted struggle on the borders of a lake into which he was plunged. The whole process must have taken place in a second or two, as the dreamer was aroused from sleep by the application of the water. Some authorities declare that all our dreams take place when we are in process of going to sleep or become awake, and that during deep sleep the mind is totally inactive. This is denied by the majority of philosophers, and with apparent reason.

Some maintain that no sleep is ever so profound as to be perfectly dreamless. Sir William Hamilton thought that we dream always, but simply forget our dreams. This proposition, which obviously cannot be proved, is supported by the fact that we forget with the utmost readiness what we know we have dreamed, and that others may see in our actions evidence of dreaming of which we ourselves afterward retain no recollection. Many facts, however, in connection with injuries to the head point in an opposite direction. Maudsley quotes the case of a boy who was rendered insensible by the kick of a horse. After trephining the depressed bone he became sensible. The surgeon took advantage of the hole in the skull to make firm pressure on the exposed brain after asking him a question. While the pressure lasted he remained silent, but the instant it was removed he made a reply, never suspecting that he had not answered at once. With an over-congested brain, there is a tendency to a rapid succession of vivid dreaming, interrupted by intervals of wakefulness. The brain cells are too excited by the excess of blood to pass into a condition of repose, and their activity tends to keep up the congestion of the organ. When the blood is deficient in quantity or quality, or poisoned by substances which ought to be removed from the body, or when the nervous system is exhausted by such causes as over-fatigue, shock, or depressing emotions from over-indulgence in any form, then unpleasant dreams are apt to follow. The onset of acute disease (especially when affecting the nervous system) is not infrequently heralded by continued dreaming or continued sleeplessness. Depressing dreams should always be regarded as an indication of need for attention to health, or to relaxation from work, more especially, perhaps, by those engaged in professional pursuits.

The special character of many dreams is determined by the condition of the organs of the thorax and abdomen, and of the muscular system. For example, the presence of indigestible food in the stomach, by embarrassing the breathing and the action of the heart, suggests the

ideas of the various forms of nightmare, the monster, or the crushing weight, from which there is no escape, which are closely akin to the sensations induced by similar effects on the heart during the day. An uncomfortable position in bed, a strained condition of the muscular system, will cause dreams of falling over precipices or of struggling. Certain drugs give a specific character to dreams. The magnificent visions of the opium stupor have been made familiar by the classical account of De Quincey. It is well to mention that the splendor of the dreams is not so certain to follow the indulgence of the opium habit as is the degradation of our mental and moral and physical nature. The furious homicidal delirium caused by *hasheesh* (Indian hemp) is indicated by its being the origin of the term "assassination." Excessive indulgence in alcohol gives rise to delirious dreams characterized by unfounded dread and suspicion. Workers in india-rubber factories, who are exposed to the inhalation of bisulphide of carbon, suffer from fearful dreams of being murdered and falling over precipices. Many other drugs induce almost as certain results. Occasionally intellectual efforts are made during sleep which it would be difficult to surpass in the waking state.

It is an interesting question how the deaf and the blind dream. Dr. Darwin records the case of a gentleman who had been deaf for 30 years, and who never dreamt of persons conversing with him except by the fingers or in writing, and never had the impression of hearing them speak. Mr. Johns, in the 'National Review' (1885), states that the blind, who can of course have no visual images, dream as actively as those that see, and dream by hearing, touching, and smelling; they tell the size of a room by the sounds of imaginary persons walking in it, recognize a friend by his voice, or by touching him, or the freshness of the morning by the smell of the air. In some forms, which may be named somnambulist dreams, in which the dream is acted as well as thought out, it is remarkable that almost no recollection is retained. The night terrors of nervous children, so frequent during their second dentition, often cause unnecessary anxiety. Dr. Clouston of Edinburgh refers to a case where a confirmed somnambulist during his sleep seized his child, to whom he was devotedly attached, and caused his death by dashing him against the wall, under the belief that he saw a wild animal in the room. The man was acquitted of the charge of murder, it being held that he was not responsible during sleep. The condition might be described as one of sanity during the waking hours, and of the opposite during sleep. Such cases are generally indications of a strong hereditary tendency to instability of the nervous system.

Among the peoples of antiquity, dreams were regarded as direct messages from the spiritual world, of either divine or diabolical origin; their interpretation was elevated to the rank of a science. At the royal courts of Babylon and Egypt the interpretation of dreams was part of the duties of soothsayers. Now the tendency is to explain away on the ground of mere coincidence the undoubted facts of foretelling the future. Some regard the apparent foretelling of the future as on a par with the working out of a problem by a mathematician. It is the solution during sleep of the question that has been oc-

cupying the mind of the deep (moral or religious) thinker.

Pseudo-psychologists believed that dreams are caused by the flight of the soul to other regions, and that on its return to the body it remembered what it had actually seen. Some persons have thought dreams the proof of the soul's immortality. This hypothesis formed the basis of the religion of Comenius and of Emanuel Swedenborg. Swedenborg strengthened the Church which he founded by his claim to have visited Paradise and his report of his experiences there. The North American Indians regarded dreams as prophetic and often took them as solemn injunctions. Among more enlightened people there may be an inducement to action from the impression of a dream; here, also, the consequence is the fulfilment of the prophecy. Such were the dreams of Judas Maccabæus, of Sylla, of Germanicus, and the dream of the priestess of Proserpine on the eve of Timoleon's expedition from Corinth to Syracuse, that Ceres volunteered to be his traveling companion into Sicily. The dream of Olympia, that she was with child of a dragon, might both have suggested the mode of education and incited the warlike spirit of Alexander. It is said that the city of Carthage was rebuilt by Augustus Cæsar in consequence of the dream of his uncle Julius. Of such a nature, too, were the dreams of the Emperor Julian and of Calphurnia; and such was the dream of Cromwell that he should be the greatest man in England. In all these, and a thousand more, the mere constant thinking excited the dream. The ambitious thought of Cromwell was constantly haunting his waking moments, pointing to personal aggrandizement, and, of consequence, imparted a like character to his slumbers.

*Bibliography.*—Andrews, 'Studies of the Dream Consciousness'; ('Amer. Journal of Psychology,' Vol. XII.); Clodd, 'Myths and Dreams' (1885); Greenwood, 'Imagination and Dreams'; Hutchinson, 'Dreams and Their Meaning'; Scholz, 'Sleep and Dreams' (1893).

J. ACKERMAN COLES, M.D.

**Drebbel, Cornelis van**, Dutch philosopher and inventor: b. Alkmaar, North Holland, 1572; d. London 1634. He lived in London from the year 1620, devoted entirely to scientific labors. He invented several philosophical instruments, among which, it is said, were the compound microscope and a thermometer consisting of a glass tube containing water connected with a bulb containing air. His contemporaries say that he displayed to King James a glass globe in which by means of the four elements he had produced perpetual motion, and that by means of machinery he imitated rain, thunder, lightning, and cold, and was able quickly to exhaust a river or lake. He discovered a bright scarlet dye for woollens and silks, which was introduced into France by the founders of the Gobelin manufactures; and the invention of the telescope has been ascribed to him, but on no good grounds. Drebbel left treatises which appeared first in Dutch (1608), and afterward in Latin, under the title 'Tractatus duo: De Natura Elementorum; De Quinta Essentia' (1621).

**Dreber, Heinrich**, known as **Franz-Dreber**, German painter: b. Dresden 9 Jan. 1822; d. Anticoli di Campagna, near Rome, 3 Aug. 1875. He began his art education at the Dresden Acad-

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emy, and became a pupil of Ludwig Richter, whose idealistic style he copied. He went to Rome in 1843 at the expense of the Dresden Academy. Two of his pictures are in the Berlin National Gallery, namely 'An Autumn Morning in the Sabine Mountains'; and 'The Hunt of Diana.' A landscape, with the figure of the 'Good Samaritan' is to be found in the Dresden gallery.

**Dred, A Tale of the Great Dismal Swamp**, a novel by Harriet Beecher Stowe, published in 1856. It belongs to the literature of the slavery agitation in the United States, and deals with the experiences of a fugitive slave. It is also called 'Nina Gordon.'

**Dred Scott Case**, the most far-reaching slavery case ever in the United States courts. Dred, born in Missouri about 1810, was a slave of Dr. Emerson, an army surgeon, who took him in 1834 to Rock Island, Ill., and May 1836 to Fort Snelling, Wisconsin Territory (now Minnesota), where he married Harriet, a slave of his master, and had two children. Slavery was illegal in both places: in Illinois by its Constitution, in Wisconsin (upper Louisiana Purchase) by the Missouri Compromise. In 1838 he was taken back to Missouri — Saint Louis.

Here in 1848 was living the eminent free-soil lawyer, Francis P. Blair, jr. He learned of Dred's migrations, and wishing to test the right of slavery to reclaim persons once free, induced Dred on being whipped by his master to sue for assault and battery in the State circuit court of Saint Louis County. Blair and his free-soil friends furnished funds and legal assistance. The suit was sustainable only if Dred was a free citizen charging violence from another citizen; and the court held that his residence on free soil had made him free, and there was no legal power to re-enslave him. Appeal was taken to the supreme court of Missouri, which reversed the decision, the two associate justices against the chief justice, decided that Emerson had only made a temporary change of domicile in obedience to government orders, that his property was held according to the laws of his permanent domicile, and that Scott's servile character was merely in abeyance and fully resumed on return to Missouri; refused to consider the Illinois Constitution or the Missouri Compromise as relevant, and sent back the case to the circuit court.

Meantime Emerson had sold Dred and his family to John F. A. Sandford of New York and suit was brought against Sandford for assault and battery in carrying off Scott — this time in the Federal circuit court for Missouri, on the constitutional ground that he was a citizen of a different State from Sandford. Sandford denied jurisdiction on the ground that Dred was not a citizen but "a negro of African descent," progeny of negro slaves. Dred's counsel demurred (admitted the facts but denied their sufficiency), claiming that being a negro did not prevent his being a citizen; the court sustained him. Sandford denied assault and battery, claiming that he had only "gently laid hands" on him to coerce him, as was his right toward a slave; the court instructed the jury that this was law; Dred's counsel took exception, and the case went up to the United States Supreme Court.

It was argued at the December terms of 1855

and 1856. Montgomery Blair (brother of Francis P.) and George Ticknor Curtis (brother of Judge Curtis) were counsel for Scott, Reverdy Johnson, and Henry S. Geyer for Sandford; all gratuitously. Justice Nelson prepared a brief abstract of the decision; but the public excitement over the slavery question was so intense and menacing to the Union (just after the Buchanan-Fremont election), that it was decided to have Chief Justice Taney write a full and careful review of the whole law on the subject of slavery, in hope of making the members of the free-soil party accept it contentedly and cease their agitation. Taney and six assistant judges concurred against Scott; Curtis and McLean dissented.

The written decisions were withheld from the public till 6 March 1857, two days after the inauguration, to avoid embroiling Pierce's last months. The decision proper was essentially the same as that of the supreme court of Missouri; that Dred Scott as a negro was not a citizen of the United States within the intent of the Constitution, and therefore the circuit court had no jurisdiction and the suit should be dismissed. This decision remained United States law, an irremovable barrier in the way of granting civil rights to the colored race, till the passage of the Fourteenth Amendment (see CONSTITUTION, *Amendments*).

Unfortunately, the court did not confine itself to the case before it; but for the reasons above mentioned, and to answer for the public the arguments brought forward by counsel, who went out of their way to deliver a series of *obiter dicta* (personal judgments not needed or relevant for the case in hand, and therefore not law), which inflamed the public wrath immeasurably as a fresh aggression of the slave power, have remained in public memory as the only interesting points in the case, and are, in fact, by far the most important aspects of it. These were three: in essence, that African negroes had never been recognized in American law or custom as persons; that Congress had no power to make regulations for the Territories acquired after the Constitution was adopted, except under the Constitution, which recognized slaves as property; and that the Missouri Compromise, already repealed by the Kansas-Nebraska Bill, had never been constitutional. (1) Of course no exception had been taken by Scott's counsel to the circuit court's ruling that negro blood was no bar to citizenship; but the Supreme Court dragged it in and overruled it. In the counsel's statement of the condition of public opinion at the time of framing the Constitution, they used a phrase which is immortal in public memory, and usually supposed to be their own decision as a point of present law: that negroes were then regarded as "so far inferior that they had no rights which the white man was bound to respect," and to be rightfully made slaves for white men's benefit. The Court held that they were regarded in the Constitution as only chattel property; were not included in the words "people" or "citizens" in the Declaration of Independence, the Articles of Confederation, or the Constitution, remained in this condition of civil nullity even when emancipated, had no rights except such as each State chose to grant them, and could not become citizens capable of suing or being sued. The dissenting judges pressed.

## DREDGE — DRELINCOURT

the notorious distinction between citizenship and suffrage (see CITIZEN); called attention to the Constitution's repeated mention of the negroes as "persons," and to the fact that free negroes were actually voters in five of the States in 1787, and were so even yet save where the States had changed their constitutions to disfranchise them; and held that the civil rights of free negroes were the same at least as those of women and minors. (2) As to the Territories, the *obiter* decision was that as the Constitution admitted slaves to be property, and by the Fifth Amendment, Congress had no right to take away any citizen's property without compensation, it had no right to make laws barring slave property from the Territories more than any other: that its rules and regulations must be in conformity with the Constitution. The dissenting judges held that both by common law and the Constitution slavery was a purely State institution (cf. Art. IV., § ii., par. 3: "No person held to service or labor in one State," etc.), sustainable only by State law and State police power of quelling resistance; that once out of the State's power, a slave instantly became free by the law of nature, and that State law could not follow him to the Territories. (3) The decision that the Missouri Compromise was unconstitutional, as interfering with the natural right of a slaveholder to take his property where he pleased, and with the constitutional equality of citizens of different States, followed from the Court's opinion on the second point. The dissenting justices held that the Compromise was a rightful exercise of the constitutional power of Congress to legislate for the Territories, and never before questioned since the government was founded; and that it did not violate the equality of citizens because citizens could only hold slave property in States that permitted and enforced it.

The whole question was soon decided by the War. Scott and his family were inherited by Calvin S. Chaffee of Massachusetts (then in Congress), were conveyed by him to Taylor Blow of St. Louis for emancipation, and were emancipated 26 May 1857. See Decision in Howard's 'Report . . . in the Case of Dred Scott' (1857); Benton, 'Examination of . . . the Dred Scott Case' (1860); Tyler, 'Life of Taney' (1872); Curtis, 'Life of B. R. Curtis' (1880). The Missouri Historical Society has a portrait of Scott, from a photograph.

**Dredge** (from Ger. *tragen*), a mechanical device for the removal of soil and other solids from under water. See DREDGING; DEEP-SEA LIFE.

**Dredging**, the operation of removing mud, silt and other deposits from the bottom of harbors, canals, rivers, docks, etc., by mechanical means. The most simple dredging apparatus is the spoon apparatus, which consists of a strong iron ring or hoop, properly formed for making an impression upon the soft matter at the bottom, so as to scoop it into a large leather bag attached to the ring and perforated with a number of small holes. The means for working it is a long handle, a suspending rope, and a crane or sweep-pole planted in a boat. This primitive apparatus was formerly used in the canals and ditches of the Netherlands. Much more effective is the steam dredging-machine now in common use. It is said to have been first applied by Boulton and Watt for use on

the Weir at Sunderland, England, in 1796. It has a succession of strong iron buckets on an endless chain running on a frame, the lower end of which is vertically adjustable so as to regulate the depth at which it works. The buckets tear up the matter at the bottom, raise it, and discharge it into barges or hoppers stationed close to the dredging vessel. The Suez Canal was excavated by means of a ladder dredge with a long chute and supporting girder. The material excavated was carried in boxes on a sort of tramway and tipped out on the bank.

In excavating at Hell Gate and Flood Rock Reefs, at New York, a barge measuring 120 feet in length, 44 in beam, and 15 in depth, used a grapple which weighed 15 tons and lifted boulders of 70 tons. In some cases the current of river or tides has been utilized in dredging channels. In bottoms of mud or loose sand the steam pump or hydraulic dredger may be used. The watery material is pumped out and deposited on the shore; the water drains away, leaving the sand or mud. By this means more than 3,000 cubic yards a day can be excavated at an extremely low cost. Great improvements have been made in hydraulic dredges, and some built in recent years for use in the Mississippi River have a capacity of over 1,000 cubic yards per hour.

Dredging is also the operation of dragging the bottom of the sea in order to bring up oysters, or to procure shells, plants, and other objects for scientific observation. The oyster dredge is a light iron frame with a scraper like a narrow hoe on one side, and a suspending apparatus on the other. To the frame is attached a bag made of some kind of netting to receive the oysters. The dredges used by naturalists are mostly modifications of or somewhat similar to the oyster dredge. Scientific dredging has of late assumed a high importance as making us acquainted with the life of deep-sea areas. See DEEP-SEA LIFE.

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**Dreibund.** See TRIPLE ALLIANCE, THE.

**Dreiser, Theodore**, American journalist: b. Terre Haute, Ind. 27 Aug. 1871. He was educated at the State University of Indiana. From 1891 to 1895 he was in newspaper work in Chicago, St. Louis, and Pittsburg. He edited 'Every Month,' a musical periodical, 1895-7, and then engaged in special work for the 'Cosmopolitan Magazine.' He has written: 'Sister Carrie'; 'Studies of Contemporary Celebrities'; 'Poems.'

**Dreissena**, drīs'sē-nā, a genus of freshwater lamellibranch mussels of the *Dreissenidae* family, so named from Dreyssen, a Belgian naturalist. *D. polymorpha*, a native of the Caspian and Aral rivers and seas, is a well-known species in the rivers and estuaries throughout western Europe, including Great Britain, where they were accidentally introduced, probably on imported timber.

**Drelincourt, Charles**, shārl drē lān koor, French Calvinistic clergyman: b. Sedan 10 July 1595; d. Paris 3 Nov. 1669. He was the author of many controversial works, and of a book entitled 'Les Consolations de l'Ame Fidèle contre les Frayeurs de la Mort,' translated into English under the title, 'The Christian's Defense Against the Fear of Death' (1675). To promote the sale

## DRENTHE—DRESDEN

of the English translation of this work, De Foe, it is said, wrote his 'Apparition of Mrs. Veal,' which was published along with the fourth edition of it in 1706. His son CHARLES (1633-9) became professor of medicine and anatomy at Leyden, and was appointed physician to William, Prince of Orange, afterward William III. of England.

**Drenthe**, drĕn'tĕ, a province of Holland, the principal wealth of which is obtained from breeding horses and rearing superior cattle, sheep, swine, and poultry of all kinds. Its capital is Assen. Pop. 148,542.

**Dresden**, Germany, capital of Saxony, situated in a valley on the river Elbe. On the left bank are the Altstadt (Old Town), Friedrichstadt, and other quarters, and on the right the Neustadt (New Town), and the Antonstadt. The municipal area received a large extension in 1897. The portion on the right bank called the Neustadt since 1732 is really the older, and was formerly known as Old Dresden. Among the structures worthy of notice are the five bridges across the Elbe, noted for their solidity, the first built in 1173; the Sophienkirche or Protestant Court Church; the Roman Catholic Court Church, which contains several fine pictures; the Church of Our Lady, an imposing edifice; the Church of St. John; the royal palace; the law courts; the Museum, a beautiful building, containing a famous picture gallery and other treasures, and forming a wing of the building known as the Zwinger, which contains zoological and other collections; the Japanese Palace (Augusteum), containing the public library of from 300,000 to 400,000 volumes, besides a rich collection of antiquities; the Johanneum, now containing the collection of porcelain and the historical museum, a valuable collection of arms, armor, domestic utensils, etc., belonging to the Middle Ages. The royal palace is unattractive externally, but has a fine interior adorned with frescoes, and the Green Vault contains a most valuable collection of jewels and small works of art. The court theatre forms a large and splendid edifice designed by Gottfried Semper, begun in 1871, and opened on 2 Feb. 1878. There is a fine park of 300 acres. The city is distinguished for its excellent educational, literary, and artistic institutions, among which are the Polytechnic School, organized much on the plan and scale of a university; several gymnasia and schools of the first rank; a military academy; the Conservatory and School of Music; the Academy of Fine Arts; the Royal School, for drawing, modeling, etc. The manufactures of Dresden are not unimportant, and are various in character; the china, however, for which the city is famed, is made chiefly at Meissen, 14 miles distant. In Dresden are made articles in gold and silver, mathematical and surgical instruments, straw hats and plait, artificial flowers, gloves, leather, cigars and cigarettes, musical instruments, chemicals, perfumes, mineral waters, chocolate, playing-cards, etc. There are large breweries, and in the neighborhood there are coal mines, iron and glass works, and manufactures of chemical stuffs, etc. The commerce is considerable, and of late years, since the development of the railway system, the trade with foreign parts has considerably increased. A good deal of business is done with the upper

parts of the Elbe, by means of the steamers, which ply as far up as Tetschen.

The gallery of pictures, one of the finest in the world, was begun very early, but first became of much importance under Augustus II., king of Poland and elector of Saxony. It owes its most valuable treasures, however, to Augustus III., a prodigal monarch, who exhausted his country by his extravagances. He purchased the greater portion of the gallery of the Duke of Modena for \$900,000, and many single pictures, among them Raphael's masterpiece, the 'Madonna di Sisto.' This celebrated painting is in a room alone, no other picture being hung near it. The pictures number about 25,000, and in particular comprise many fine specimens of the Italian, Dutch, and Flemish schools. From the Dutch school there are, among others, some 40 Rubenses, 20 Van Dycks, over 20 Rembrandts, besides Ostades, Gerard Dows, Teniers, Wouwermans, etc. Of the old German school Holbein's 'Madonna,' a sublime work, is particularly distinguished. Of the French school there are many Claude Lorraines, Poussins, Le Bruns, and others. Of the Italian school the gallery is rich in pictures of Correggio, including his famous 'La Notte,' or 'Holy Night'; of Raphael, the 'Madonna di Sisto,' the 'Madonna della Seggiola,' and others. There are also works of Leonardo da Vinci, Giulio Romano, Andrea del Sarto, Battoni, Titian, his famous 'Venus' and 'The Tribute Money,' Garofalo, Paolo Veronese, Guido Reni, Carracci, Carlo Dolce, and every distinguished Italian painter. Many modern painters are represented in this gallery, among them Hofmann, and several specimens from the Düsseldorf school. Murillo and Velasquez are remembered by one picture each. This collection is liberally open every day to all visitors. Besides this fine gallery of pictures the Museum contains also a collection of engravings and drawings, in all amounting to upward of 350,000. There is here also a rich collection of casts exemplifying the progress of sculpture from the earliest times, and including copies of all the most important antiques, made under the direction of Raphael Mengs, in Italy. The collection of antiques in the Japanese Palace contains some excellent statues, among which are distinguished three female figures from Herculaneum. The Johanneum Museum contains a historical museum and a large variety of specimens of Chinese, Japanese, East Indian, Sèvres, Meissen, etc., porcelain ware arranged chronologically. Dresden being thus rich in treasures of art, and favored by a beautiful natural situation, is the summer resort of many foreigners.

Dresden is of Slavonic origin, and first came under German and Christian influence after the subjugation of the Slavs about the year 922. At the beginning of the 13th century it is mentioned in documents as a city, and as a residence of the margraves of Meissen. Since 1485 it has been the residence of the rulers of Saxony. In the first half of the 18th century it was greatly embellished, but suffered much in the Seven Years' war. In 1760 for nine days it was bombarded by Frederick the Great. The Austrians occupied the city in 1809 without injuring it. The campaign of 1813 was most ruinous for the city and its environs. From May till about the middle of September it was held by Napoleon, and severe fighting in and around the city took place almost every day. After some years



## DRESDEN — DRESS

of war and suffering, on 7 June 1815, peace and industry returned to the "German Florence," as Herder calls Dresden. After that time dwelling houses, gardens, and parks took the place of the former fortifications. During the revolutionary movement of 1849 it suffered severely. In 1866 it was occupied by the Prussians, but was evacuated in the following spring. It has been greatly beautified and extended in recent times (especially under the auspices of King John), and its population is rapidly increasing. Pop. (1900) 395,349.

**Dresden, Battle of**, a battle fought in 1813, when an allied army of 150,000 Russians, Austrians, and Prussians, commanded by Prince Schwarzenberg, sought to regain possession of Dresden, which was occupied by 20,000 French troops under Saint-Cyr. The Allies appeared before Dresden on 25 August, but Schwarzenberg did not attack until the following morning, when each division drove back the French and gained advantageous positions in the city, so that it appeared as if Saint-Cyr would be forced to capitulate. In expectation of reinforcements and satisfied with the morning's achievements, Schwarzenberg at noon called a halt. The delays proved fatal. Napoleon, who had gone to the support of Ney, against Blücher in Silesia, on learning of the Allies' march on Dresden, had hastened back, and during Schwarzenberg's unfortunate halt, French reinforcements were flocking across the Elbe, so that at 4 o'clock in the afternoon, when the Allies resumed the attack, there were 100,000 troops, who easily opposed all their efforts and drove them from their hard-won positions. Darkness stopped the conflict, which Napoleon resumed early the next morning, the fight continuing throughout the day until a strategic cavalry charge under Murat in the rear of the Austrians broke their line of resistance and practically ended the battle, the Allies beginning their retreat into Bohemia at 4 in the afternoon. The French took over 20,000 prisoners, while the killed and wounded on either side were estimated at between 7,000 and 8,000.

**Dresden China**, a delicate, semi-transparent, highly finished china made at Meissen, near Dresden. The manufacture resulted from an accidental discovery made by Böttger, a young chemist, in 1710, and the vases, statuettes, groups of figures, candelabra, clocks, etc., manufactured during the 18th century are highly prized. They are more remarkable for excellence of execution than for purity of design.

**Dress**, the clothing or apparel of the human body. Under this title may be considered the subject of the principles underlying the wearing of clothes rather than the minute details of their shape and color, which will be found under the title **COSTUME**. The evolution of dress has always been associated with the growth and decline of nations, and throws much light on racial characteristics. In the earliest stage of human history dress must, of course, have been strictly utilitarian, consisting only of the covering necessary to protect the body against the extreme conditions of climate and temperature. The same conception of dress exists to this day, undeveloped, among many uncivilized races.

At the beginning of civilization, a new element enters into the way in which dress is

regarded. Clothing becomes a means of marking the distinction of rank and office in the community. The minimum of clothing is found, with these races, only among slaves and the lowest classes in general, while garments even more complete than would be required by any considerations of modesty or of warmth begin to be worn by those in the higher ranks. Climate has still, of course, an influence concurrent with that of the new principles. The Assyrians covered themselves entirely with heavy draperies, stiff with embroidery. The Egyptians of whose dress we have the earliest records, clothed themselves in thin materials which revealed the lines of the body, frequently leaving the limbs exposed. Their dress was rich in texture and splendid in coloring, the designs of their textile fabrics being of high artistic excellence and beauty. Class distinctions were very strongly marked in their dress. A peculiar feature of the priestly garb was the leopard-skin worn on solemn sacrificial occasions. Women of rank wore beautiful embroidered skirts secured at the waist by a colored sash, or suspended by straps from the shoulders, and over this a long, loose robe. The laboring people used woollen fabrics, but their costumes, especially when at work, consisted as a rule simply of a loin-cloth and girdle. Among the Chinese the predominating idea in dress has always been splendor of material and decoration. The intense conservatism of this race is nowhere better shown than in the slightness of variation in dress from early times to the present. It will be observed in general that when a race makes a great, and especially a sudden, advance in civilization, it breaks away concurrently from its old traditions in the matter of dress. This is illustrated in the case of the modern Japanese. For a long time the figure was merely draped in loose lengths of material, with no attempt at conforming to the lines of the body or limbs—though sleeves and trousers are occasionally observed, as in the Persian sculptures at Persepolis. The primitive sandal was evidently thought to afford all necessary protection to the foot, until the time of Assur-bam-pal, or Sardanapalus, when soldiers and hunters are found to have worn a sort of net to protect their legs, and boots or gaiters somewhat like the Greek and Roman *cothurnus*, laced in front. Hats or caps were not, outside of official costume, much worn in early times. Even in the time of Julius Cæsar, they were little used except by travelers, most people preferring a fold of the toga or mantle for a head-covering. Among the Greeks and Romans the division of classes and professions by dress was very noticeable. By the Greeks the artistic effect was carried to a height hitherto unknown, their garments being the perfection of grace and dignified elegance. At no other time has the dress of a nation been of such advantage to the artist. The Greek *chiton* and *himation* of about 450-350 B.C. were the highest type of loose clothing, while the highest type of the more tightly fitting costume was found in England and France about 1350. The costumes of western Europe during the last quarter of the 14th and the first of the 15th century, were, in fact, characterized by a beautiful reasonableness and adaptation at once to use and artistic effect. But there have been other periods in which the exaggeration of good things brought about absurd



## DRESS REFORM — DRESSER

degeneracy. The Norman conquest introduced a host of absurdities into England. Eccentricities in headgear especially prevailed. Shoes grew so long and pointed that they were an encumbrance to the wearer. Small waists were considered quite as essential for men as for women, and, even as late as the reign of George III. in England, tailors advertised corsets for gentlemen. The modern tendency in dress is decidedly in favor of discarding a difference of dress as a means of class distinction. The dress-reform movement of the 19th century, and the greater attention paid to hygienic considerations, have resulted in making the health and comfort of the body more important factors than they have been for many centuries. Extravagance in dress has always been a mark for social and religious reformers. Sumptuary legislation has attempted, time and time again, to regulate it, but usually without success. Both in France and in England, especially during the Puritan period in the latter country, preachers thundered from many a pulpit against the senseless fashions of their times. There are two satirical literary treatments of this aspect of dress which are especially famous, that of Swift, in the 'Tale of a Tub,' and that of Carlyle in 'Sartor Resartus.' See DRESS REFORM.

**Dress Reform,** a movement of the 19th century, having for its aim the modification of the dress of women along hygienic lines chiefly, but also with regard to comfort and convenience. Many forms of feminine apparel had long been operating against the health of the wearers, and the injurious effects had been more or less frankly discussed and recognized in private circles before leaders were found with sufficient earnestness and courage to undertake organized efforts for reform. A few years before the Civil War a National Dress Association was started, but made little headway. It was not until a similar society was organized in Boston in 1874 that attempts of this nature began to bear much fruit. Several causes contributed to make the time more propitious for an active propaganda against tight-lacing, high-heeled, and cramping foot-wear, trailing garments, etc. The greater attention paid to physiology in schools removed to some extent the ignorance which had been a partial excuse for unhygienic methods of dress. The increasing number of women receiving a college education insured for the new ideas an audience with minds too liberal and judgments too sound to be rigidly fettered by conventionality and fashion. A third factor not to be disregarded was the attitude of physicians. Prevention of disease and the development of normal conditions was becoming the watchword, where curative measures had formerly been emphasized. The co-operation of the medical fraternity by lectures, periodical literature and personal influence should have due recognition in the cause of dress reform. Such co-operation was a marked feature of the movement inaugurated in Boston. As the century drew to a close, conditions became still more favorable. The prominence given to bacteriology associated in innumerable minds the trailing skirt with germ-transportation. The investigation of the relative values of the different fabrics, cotton, linen, silk, and woolen, as material for underwear (a discussion in which Germany took a notable part), was very timely. It

called attention to the great lack of judgment exhibited by many persons, especially women, in protecting themselves by suitable undergarments against the changes of the season, and especially the sudden variations of the American climate. The adoption of outer garments suitable for wet weather was undoubtedly hastened by the vogue of the bicycle skirt that accustomed the eye to a style of garment once attracting unfavorable comment, or at least unwelcome observation. Rainy-day clubs have been formed in many cities and have done their share toward the introduction of the short skirt. The fact that a great number of women are now daily going to business has aided in bringing about a change in favor of simple, comfortable, and convenient garments. To athletics, also, dress reform is deeply in debt. The present popularity of out-door exercise and sport for women, and the general interest taken in physical culture have inevitably tended to modify the form of women's garments.

The practice of lacing, with its vicious results of molding the form into abnormal lines and crowding the vital organs, will undoubtedly persist among a certain class of women; but thousands are learning to admire and aim at the vigor and grace that can be obtained only by freedom of movement. Aesthetic considerations had little effect upon the earliest dress-reformers, such as Mrs. Amelia Bloomer and a few other woman suffragists who first braved public opinion by a radical change of costume. The Turkish trousers and very short skirt of Mrs. Bloomer did not invite imitation; but later phases of the reform, both in England and in America, have aimed at grace and beauty as well as health and convenience in the style of garments advocated. In the United States Mrs. Annie Jenness Miller has been a prominent exponent of the more artistic aspect of the subject. Very near the time of the establishment in this country of the second National Dress Association, an attempt was made by the crown-princess of Saxony to awaken her fellow countrywomen on the subject of dress reform, the hygienic side of the question being most prominent in that effort. In England a movement begun during the same decade was marked by aesthetic features. To retain the natural beauty of the human form, and succeed in its harmonious appareling were the aims of some of the dress reformers. There was, however, side by side with this movement, one having a utilitarian trend. This was allied to the German movement in favor of more hygienic garments; the combination of lightness and warmth in the material used being a great desideratum. Organized effort along the line of dress reform in England has resulted in the formation of the Rational Dress Association and the National Health Dress Association. There is also a society having for one of its aims a change in the customary mourning apparel. Outside of Germany and England, little interest has as yet been shown in Europe on the subject.

**Dresser, Henry Erles,** English ornithologist: b. Thirsk, Yorkshire, 9 May 1838. He is best known by his 'History of the Birds of Europe,' in eight volumes (1871-81).

**Dresser, Horatio Willis,** American author: b. Yarmouth, Maine, 15 Jan. 1866. After a varied career he became identified with one of the so-called "new thought" movements, of which

## DREUX — DREWRY'S BLUFF

he is now a prominent representative. Since 1893 he has lectured and written extensively on practical philosophy and metaphysics, and he edited and published the 'Journal of Practical Metaphysics' 1896-8; but it must be pointed out that these terms, as used by him and his school of thought, have meanings entirely different from those in which they have hitherto been used and are generally understood. He is the author of: 'The Power of Silence' (1895); 'The Perfect Whole' (1896); 'In Search of a Soul' (1897); 'Voices of Hope' (1898); 'Methods and Problems of Spiritual Healing' (1899); 'Education and the Philosophical Ideal' (1900); 'Living by the Spirit' (1900); 'Voices of Freedom' (1899-1900); 'The Christ Ideal' (1901); 'A Book of Secrets, with Studies in Self-control' (1902).

**Dreux**, drê (ancient DUOSCASSÆ), France, one of the oldest towns on the Blaise, 20 miles north-northwest of Chartres. It has a number of churches and other buildings of the 11th, 12th, and 13th centuries. It has some manufactories, but its trade is chiefly local. Pop. 9,000.

**Drevet**, drê-vâ, French family of engravers. (1) **PIERRE**: b. St. Colombe, near Lyons, 1664; d. Paris 1739. He was particularly successful in the engraving of portraits. (2) **PIERRE IMBERT**, his son: b. Paris 1697; d. there 1739. He studied with his father, but surpassed him in art. He, too, was most successful in portrait work, one of his best pieces being a portrait of Bossuet after Rigand; he also copied the works of Coypel, Restout, Andray, and other French painters of the time. (3) **CLAUDE**, the nephew of Pierre Imbert: b. Lyons 1710; d. Paris 1782. He was the pupil of his uncle, and copied his style without equaling his art.

**Drew**, Daniel, American capitalist: b. Carmel, N. Y., 29 July 1797; d. New York 19 Sept. 1879. In early life he was a cattle drover and was subsequently prominent as a steamboat builder, but was most widely known from his connection with railroads and as a leading stock speculator in Wall Street. He was the founder of the Drew Ladies' Seminary at Carmel, and the Drew Theological Seminary (q.v.) at Madison, N. J. He also gave large sums of money to various Methodist colleges and schools.

**Drew**, John, American comedian: b. Dublin, Ireland, 3 Sept. 1825; d. Philadelphia, Pa., 21 May 1862. He made his first appearance at the Bowery Theatre, New York, in 1845, and later became manager, in connection with William Wheatley, of the Arch Street Theatre in Philadelphia. He acted in the principal cities of the United States, England, and Australia.

**Drew**, John, American actor: b. Philadelphia, 13 Nov. 1853. He is a son of the preceding and first appeared at his father's theatre in that city, and for a short season played there with Edwin Booth. He visited Europe in 1892 with Daly's company, playing classic roles, and began his starring tours in the autumn of 1892, playing in 'The Masked Ball.' In 1901 he reduplicated some of his earlier successes in 'The Second in Command.'

**Drew**, Mrs. John. See **DREW**, LOUISA LANE.

**Drew**, Louisa Lane, American actress: b. London, England, 10 Jan. 1820; d. Larchmont, N. Y., 31 Aug. 1897. She was the wife of John Drew (1825-62) and for a whole generation stood at the head of comedy actresses. Her

greatest success was as Mrs. Malaprop in 'The Rivals,' and as late as 1895 she assumed that character in some special performances given by veterans of the stage, such as Joseph Jefferson, etc. After her husband's death Mrs. Drew managed the Arch Street Theatre in Philadelphia for a number of years.

**Drew Theological Seminary**, in Madison, N. J., an educational institution founded by the Methodist Episcopal Church for the education and training of its ministers. Daniel Drew donated the ground and buildings. Tuition is free and arrangements have been made whereby the cost of student life is most moderate. In 1902 there were enrolled 180 students with seven professors. In the library were 76,000 volumes.

**Drewry's Bluff**, Va., an eminence on the James River, near Fort Darling, eight miles south of Richmond. See **DREWRY'S BLUFF**, BATTLE OF.

**Drewry's Bluff, Battle of**. When Gen. Grant began his campaign for Richmond in May 1864, Gen. Butler, commanding the Army of the James, was directed to be well up James River toward Richmond by daylight of the 5th and to push ahead with all energy. By the 6th Butler had reached and entrenched at Bermuda Hundred Neck, Kautz's cavalry division, moving from Suffolk, destroyed several bridges on the Norfolk & Petersburg and Weldon railroads and joined Butler on the 10th. On the 9th Butler advanced with the greater part of his force to strike the railroad connecting Richmond and Petersburg, but his advance was barred by Swift Creek, which was found impassable, and its bridges heavily guarded, upon which he ordered his troops to withdraw to their entrenchments, but the withdrawal was not effected without an attack by the Confederates on a detachment of the 10th Corps, in which the loss was severe on both sides. Butler's advance was barred by strong works on Drewry's Bluff, on the right bank of the river, eight miles below Richmond. The works could not be reached by the navy, and on the land side the Bluff was defended by 22,000 infantry and over 2,000 cavalry, field artillery, and heavy guns. On the 12th Gen. Butler moved along the turnpike and after some fighting the Confederates fell back toward Drewry's Bluff. On the 15th there was heavy all-day skirmishing and some artillery firing, and Gen. Beauregard issued orders for an attack next morning to cut Butler off from Bermuda Hundred and capture or destroy his army. The attack was made very early in the morning, under cover of a dense fog; the right of Butler's line was turned and a large number of prisoners taken, compelling it to fall back a short distance. On the left Butler's line held its ground and made some progress, but toward evening Butler ordered his troops to fall back, and at night they were in their entrenchments at Bermuda Hundred. Beauregard followed and entrenched in front of Butler's lines. As Gen. Smith says, "Both corps re-entered the historic bottle, which was at once carefully corked by a Confederate earthwork." On the 20th Beauregard assaulted and carried some of Butler's advanced lines and a sharp fight ensued to regain them, which was only partially successful, a portion of them being retaken by Howell's brigade of the Tenth corps, which lost 702 men;

## DREXEL — DREYFUS

the Confederate loss was nearly 800. On the 29th Gen. Smith with three divisions of the Tenth and Eighteenth corps, 16,000 men, and 16 guns, left the Army of the James and joined the Army of the Potomac, in time to take part in the battle of Cold Harbor. The Union forces engaged in the Battle of Drewry's Bluff, 16 May, numbered about 16,000; the Confederates about 18,000. The Union loss, 14-16 May, was 390 killed, 2,380 wounded, 1,390 missing. The Confederate loss, 16 May, was about 460 killed, 2,060 wounded, 212 missing. From 5-31 May, including all of Butler's engagements and Kautz's cavalry operations, the Union loss was 609 killed, 3,769 wounded, 1,580 missing; the Confederate loss for the same period cannot be definitely ascertained, but it was less than that of the Union forces. See 'Official Records,' Vol. XXXVI.; 'Butler's Book'; Grant, 'Personal Memoirs'; Humphreys, 'The Virginia Campaign of 1864-5'; Roman, 'Military Operations of Gen. Beauregard,' Vol. II.; and 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. CARMAN.

**Drexel, Anthony Joseph**, American banker; b. Philadelphia, Pa., 1826; d. Carlsbad, Germany, 30 June 1893. He became the head of the well-known firm of Drexel & Company, Philadelphia, having been identified with it from the age of 13. He was zealous in promoting science and art, especially music, and contributed largely to philanthropic and educational interests. The Drexel Institute of Art, Science and Industry, Philadelphia, dedicated 18 Dec. 1891, was established by him, the building costing over \$600,000 with an endowment fund of \$1,000,000.

**Drexel Institute of Art, Science, and Industry** was founded at Philadelphia in 1891, by Anthony J. Drexel (q.v.). This school was established for the purpose of giving young men and women opportunity to receive training in the arts and sciences as applied to the industries. The requirements for admission depend upon the course which the applicant wishes to pursue; no degrees are given. The buildings and equipments, given by Mr. Drexel, cost over \$4,000,000; and the amount of endowment, given also by Mr. Drexel, is \$2,000,000. The courses offered are: Fine and applied arts; elective engineering; commerce and finance; mechanical drawing and machine construction; domestic science; mathematics; physics; chemistry; and English. Day and evening classes are provided for all departments. The length of time required to complete the work depends upon the course. The free public lectures provided by the Institute are valuable educational factors.

The department of commerce and finance consists of three special departments: First, the course in commerce and finance; second, the office course; third, the evening course. These courses are founded on a broad and liberal basis, resembling generally the commercial schools of Europe, and they are intended to place commercial education in its proper relation to other departments of educational work. The object of the course is to train the young to do business rather than simply to record business. It provides a liberal and practical course of study for a two years' training in the knowledge of the world's industries and markets, the laws of

trade and finance, and the mechanism and customs of business. The first special department is intended to give a thorough fundamental training for the activities of business which include: (1) The production, sale, and transportation of articles of commerce; (2) the management of stock companies and corporations; (3) the buying and selling of securities; (4) the importing and exporting of merchandise; (5) the borrowing and lending of money and credit; (6) the advertising of commercial concerns; (7) the keeping of business records. In addition three distinct office courses are offered, practical in character and designed to prepare the student for entering immediately upon the respective lines of employment to which the training leads. In 1895 a beginning was made toward the formation of a permanent commercial museum. The collection now represents quite fully the following industrial products: Flour, wool, petroleum, tea, coffee, sugar, cotton, copper, iron and steel, glass, tobacco, leather, paper, wood, carpets, linen, spices, aluminum, building stone, brick, and terra-cotta. The art museum contains collections representing the industrial arts of Egypt, India, China, Japan, and Europe. The library contains about 30,000 volumes, and is supplied with books, periodicals, and pamphlets bearing upon the work, and every facility and assistance is afforded for the study of financial, economic, and commercial questions. In 1902 the number of students in attendance in the day classes was 1,200 and in the evening classes 2,000. Applicants for admission to any course must pass satisfactory examinations in English, geography, arithmetic, and United States history. For admission to the course in commerce and finance or to any of the office courses the candidate must be at least 16 years of age. The diploma of a high school of approved standing is accepted in place of an examination.

**Dreyfus, drä-füs, Abraham**, French playwright; b. Paris, 20 June 1847. He had a fine vein of kindly humor, and it pervaded both his contributions to the public journals and his theatrical compositions, which are mostly in one act. Among them are: 'A Gentleman in Black'; 'The Victim'; 'The Klepht'; 'A Break.' His four-act play, 'The St. Catharine Institution,' a comedy of manners, was brought out at the Odéon (1881); 'A Rupture' (1885); etc.

**Dreyfus, Alfred**, French military officer; b. Alsace 1859. He was a member of a wealthy Jewish family. On 14 Oct. 1894 he was arrested on a charge of communicating certain important military documents to a foreign government, and at a secret court-martial, on 19 December, and succeeding days, was found guilty and condemned to public degradation and lifelong imprisonment. He was degraded on 5 Jan. 1895, and in accordance with an act passed by the chambers was sent to the Ile du Diable (Devil's Island) near Cayenne, to undergo the other part of the sentence. On 1 June of the same year Col. Picquart became head of the Intelligence Department of the army, and in the course of his official duties discovered various circumstances which threw doubt on the correctness of the court-martial's decision, and pointed to another officer, of the name of Esterhazy, as the real

## DREYFUS CASE — DRIFT

traitor; and in particular he obtained a copy of a telegram-card, subsequently known as the *petit-bleu*, alleged to have been addressed to Esterhazy by a German officer, Col. von Schwarzkoppen. On 7 Sept. 1896, he wrote to Gen. Gonse urging a reinvestigation of the case, and seven days later a newspaper divulged the fact that certain documents had been communicated to the court-martial unknown to the prisoner's counsel. Not long afterward a facsimile of the *bordereau* (memorandum, detailed list of documents), alleged to have been written by Dreyfus and largely contributing to his condemnation, was published in another newspaper, and on 16 November, Col. Picquart was superseded in his office by Col. Henry. On 15 Nov. 1897, M. Mathieu Dreyfus, brother of the condemned man, charged Esterhazy with having written the *bordereau*, but on 11 Jan. 1898 he was acquitted by a court-martial which sat with closed doors. On the following day Col. Picquart, who had been sent to Tunis after his dismissal from office, and had been afterward recalled to answer certain charges made by Esterhazy, was arrested and imprisoned. On 13 January, M. Zola, the eminent novelist, published in the *Aurore* a letter headed *J'accuse* (I accuse), in which he made serious charges against the general staff and the government in regard to the Esterhazy court-martial. After a stormy debate in the chamber it was decided to prosecute him; but the government steadily refused to reopen the Dreyfus case, declaring their determination to stand by the *chose jugée*. Zola's trial began on 11 February, and on the 23rd he was condemned to pay a heavy fine and to undergo a term of imprisonment. On 2 April the court of cassation quashed the sentence on Zola on technical grounds, but a fresh prosecution was ordered a few days later. On 27 June M. Cavaignac became head of the war office, and 7 July he read to the chamber several documents which he regarded as proving the guilt of Dreyfus, but three days later Col. Picquart wrote to the premier denouncing these documents as forgeries. This interference led to his rearrest, and shortly after Zola was again condemned. On 31 August Col. Henry was arrested, and confessed to having forged the chief document relied on by Cavaignac, but soon after his arrest he committed suicide. The war minister resigned 4 September, and was succeeded by Gen. Zurlinden. The latter resigned because of the government's determination to refer the question of revision to a commission, and on 18 September Gen. Chanoine succeeded him. The commission decided against revision, and on 26 September the government resolved to ascertain the view of the court of cassation. On 25 October the Brisson ministry resigned, and a few days later the court reported in favor of revision. On 31 October a new ministry under M. Dupuy came into office, and on 9 December the prosecution of Picquart was stopped by the court of cassation. On 16 Feb. 1899, M. Félix Faure, the president of the republic, died suddenly, and three days later was succeeded by M. Emile Loubet. On 3 June of the same year the court of cassation, having concluded its hearing of the evidence, ordered a fresh court-martial to be held at Rennes for the purpose of deciding whether Dreyfus communicated to a foreign government any of the documents mentioned in the *bordereau*, of which Esterhazy had previously

confessed himself to be the author. Picquart was released on 9 June, and on the 12th of the same month the ministry was defeated. On 22 June M. Waldeck-Rousseau succeeded in forming a new ministry. The new court-martial opened 7 August, under the presidency of Col. Jouaust, and about this time the press published accounts of the inhuman treatment of Dreyfus in his prison. Dreyfus, who had been brought to Rennes for trial, was defended by MM. Demange and Labori. The chief witnesses in favor of the prisoner were Col. Picquart and Capt. Freystätter, a member of the first court-martial, and against him were the Gens. Mercier, Gonse, Roget, de Boisdeffre, and Billot. An attempt to kill M. Labori on his way to court 14 August was fortunately unsuccessful. On 8 September M. Demange delivered a brilliant speech on behalf of the prisoner, but on the following day the judges, by five votes to two, declared the prisoner guilty, with extenuating circumstances. This verdict was so flagrantly opposed to the published evidence (this court-martial held most of its sittings in public) that it was received with indignation and contempt throughout almost the whole civilized world. Dreyfus was sentenced to 10 years' imprisonment in a fortress, but a subsequent full pardon from President Loubet set him at liberty. Several times during the progress of the case France seemed on the verge of revolution, and anti-Semitic fanaticism and insane glorification of the army proceeded to almost incredible lengths. The case lasted during the tenure of office of six ministries and formed a subject of official consideration for three presidents and nine ministers of war.

*Bibliography.*—See Dreyfus, 'Five Years of My Life' (1901); Barlow, 'History of the Dreyfus Case' (1898); Conybeare, 'The Dreyfus Case' (1898); Eugon, 'The Dreyfus Case' (1898); Steevens, 'The Tragedy of Dreyfus' (1899); Marin, 'Comptes-rendus officiels' (1897); Vanex, 'Dossier de l'affaire Dreyfus' (1898); Brez, 'Le solécisme du bordereau et des lettres de Dreyfus' (1898); Esterhazy, 'Les dessous de l'affaire Dreyfus' (1898).

**Dreyfus Case.** See DREYFUS.

**Dreyschock, Alexander**, Bohemian pianist and composer: b. at Zack, Bohemia, 15 Oct. 1818; d. Venice 1 April 1869. After eight years' public concert performance he began to travel, in 1838, for the purpose of developing his art. In response to an invitation from the directors of the Imperial Conservatory, St. Petersburg, he visited that city. There he stayed from 1863 until failing health compelled him to seek a milder climate.

**Dreyse, Johann Nikolaus von**, yō'hān nīk'-o-lows fōn drī'zē, German inventor: b. Sömmerda, Erfurt, Prussia, 20 Nov. 1787; d. 9 Dec. 1867. He worked as a locksmith in Germany, and in a musket factory in Paris 1809-14. He then founded an ironware factory in Sömmerda, and began the manufacture of percussion-caps under a patent in 1824. In 1827 he invented a muzzle-loading, and in 1836 a breech-loading needle-gun, which was adopted in the Prussian army in 1840. A large factory was at once established, which produced 300,000 weapons between 1841 and 1863. In 1864 Dreyse was ennobled.

**Drift**, or **Glacial Drift**, a general name given to the deposits made by the ice sheets of

## DRIFT SAND — DRILLS

the glacial period, or by the water which came from them. By some geologists the term is restricted to the unsorted deposits left by the ice itself, the deposits worked over by water being called stratified or modified drift. In this restricted sense drift includes (1) lateral and terminal moraines and (2) till, boulder clay or "hardpan," the sheet of clay that frequently covers rock surfaces in the glaciated regions. Drift is sometimes more or less sandy and always contains angular boulders with polished and often striated surfaces, the boulders being scattered through the clay without order. Usually the boulders are derived from rocks near by, but fragments of tough hard rocks were sometimes transported long distances before being ground up by the action of the ice. Thus boulders from the peridotite at Cumberland Hill, R. I., have been found in the till of Martha's Vineyard, Mass., over 30 miles distant. The exact method by which till was formed is in dispute among geologists, though it is generally regarded as the ground moraine of the ice sheet, in spite of the fact that present glaciers are not forming a similar deposit. The boulders in the till in New Zealand are sometimes as much as 20 feet in diameter and in some places the till is so full of boulders as to render the soil formed from it unfit for agriculture. In northwest Ohio the till in many places is over 100 feet deep and as it includes the detritus from softer rocks such as limestones, in that region boulders are fewer than in New Zealand and the resulting soil is very fertile. Englacal drift is the rock detritus carried along in the body of a glacier. See GLACIER; GLACIAL PERIOD; SOIL.

**Drift Sand** is sand thrown up by the waves of the sea and blown when dry some distance inland until arrested by large stones, tree roots, or other obstacles, round which it gradually accumulates until the heaps attain considerable dimensions. When these mounds have reached a certain elevation they are urged farther inland. "The same wind," says Cuvier, "that drives the sand from the sea upon the mound, drives the sand from its summit to its land side." In some parts of the coasts of France, the Landes of Brittany, in particular, these inroads upon the land have been attended with destructive consequences. The quantity of sand annually deposited along that coast is estimated at 3,000,000 cubic feet, and its annual progress inland some 72 feet. Such has been its destructive effects upon a village of Brittany that nothing is visible of it except a portion of the church steeple. For the purpose of arresting the inland progress of drift sand various measures have been adopted, the most successful being the planting of sand-loving plants with long creeping roots, such as *Carex arenaria*, which help to fix the sand and break the influence of the wind. In France the drift sands of the Biscay gales have been checked in their encroachments by the planting of fir-trees in solid belts along the shores.

**Drill**, a baboon of West Africa, the *Cynocephalus leucophæus*, closely allied to the mandrill (q.v.), whence its abbreviated name. It is, however, smaller than the mandrill, has a black face, and a short, erect tail, not two inches long.

**Drill, Borer, or Snail-bore**, a small muricine gastropod mollusk the American *Urosalpinx cinerea*, so named on account of its destructive

propensities in boring through the shells of young oysters and feeding on them. The drill occupies a spiral, brownish shell, about an inch long, and is found along the Atlantic coast north of Florida, becoming scarce above Massachusetts.

**Drilling**, sowing in parallel rows as distinguished from sowing broadcast. It was introduced into England by Jethro Tull, who published a work on the subject in 1731. He saw that mere plowing and rough harrowing were not cultivation, but only its rudimentary operations; and that the soil required to be stirred and pulverized, not only before sowing, but also after the plants had appeared above ground, in order that weeds might be extirpated and fresh particles of soil brought in contact with the roots of the crop. The plan of sowing in drills or ridges, and hoeing in the intervals was therefore adopted by Tull as the best means to attain his objects. The advantage of sowing in drills has stood the test of experience, and drill husbandry, by combining the advantages of continued tillage with those of manure and a judicious rotation of crops, is a marked improvement on the old mode of sowing all seeds broadcast. The crops which are now generally drilled are turnips, potatoes, beans, peas, carrots, clover, cereals, flax, etc. Drilling is of more importance on dry than on moist soils, as in the former weeds are more apt to spring up and injure the crops.

**Drills, or Drilling Machines**, instruments such as rock drills, percussion drills, diamond drills, etc., for perforating stone, metal, and other hard substances, as distinguished from wood-boring tools. Under the article BORING, descriptions will be found of these various machines, to which may be added that of the steel-shot core drill, a recent Australian invention, and an inexpensive substitute for the higher priced diamond drill. Mr. Davis, the inventor, first attempted the construction of a toothed bit or cutter made of hardened steel. With this he was successful in soft and moderately hard rock, but for the hardest formations he still had to use a diamond drill. It was not until he had invented the "shot bit" that the diamond drill could be entirely dispensed with. This bit is a soft steel cylinder in connection with which small chilled steel shot are used. The bit grinds the shot into the rock, thus gradually wearing it away, or to be more correct the action of the shot on the rock is one of crushing rather than grinding, and for this reason the smooth bearing surface of the shot bit shows but little wear.

The arrangement of the drill and its accessories is as follows: The hollow drill rods are rotated by any available geared driving means. The lower drill rod is surrounded by a "calyx" or tube, and the two are joined at their lower ends by a plug. The centre portion of the plug serves as a bearing for a protecting ring, and on its lower end a ring is threaded, while to this the core barrel is attached on which either the shot bit or the cutter can be threaded. The shot bit is provided with a triangular notch in its lower end, one of the walls of the notch being vertical and the other forming an angle of 30° therewith. The steel shot, which are fed through the hollow rods from the top, are carried by a current of water under this notch, and the inclined wall drags them under



the edge of the shot bit. The sizes of shot used vary with the nature of the rock to be drilled, some being as large as duck shot and the smallest being very much finer. The working edge of the shot bit is rounded, so that the shot grinds not only directly beneath the drill, but also to a certain extent at the inner and outer sides, thus cutting out proper clearance for the operation of the drill. Water is pumped into the hollow drill-rods through a pipe and passes out under the bit and up the annular space outside the core barrel, carrying with it the sludge or fine particles ground up by the shot. The current of water flows with great strength up as far as the top of the calyx, where the annular space widens considerably, so that the current is reduced and the sludge it carries drops by gravity into the calyx; the calyx, therefore, providing an additional record of formations penetrated. It is particularly useful when drilling with the cutter bit through matter which is too soft to form a good core.

The weight of the drill-rods is ordinarily sufficient to properly feed either the shot bit or the cutter. When additional pressure is necessary, this may be exerted by turning a hand-wheel geared to a pair of winding drums, on which are coiled the ends of a strap passing over pulleys at the top of the drill. When it is desired to remove the core, coarse gravel is poured down the hollow tubes, which wedges in between the core and core barrel so tightly that on lifting out the core barrel the core breaks away and comes up with it.

**Drimys**, *drī'mīs*, a genus of plants belonging to the order *Magnoliaceae*. They are distinguished by their bitter, tonic, and aromatic qualities. *D. winteri*, or *aromatica*, carried to Europe by Captain Winter from the Straits of Magellan in 1579, yields Winter's bark, which has been employed medicinally as an aromatic stimulant. It somewhat resembles canella bark. The bark of *D. granatensis* is used in Brazil against the colic. It is tonic, aromatic, and stimulant. That of *D. axillaris*, a native of New Zealand, has similar qualities.

**Drink.** See DIETETICS.

**Drip Stone**, a corona or projecting tablet or molding over the heads of doorways, windows, archways, niches, etc., to prevent rain-water from trickling down. Called also a label, weather-molding, water-table, and hood-molding. The term label is usually applied to a straight moulding. Also a filtering stone, so called by sailors.

**Drisler, Henry**, American classical scholar: b. Staten Island 27 Dec. 1818; d. New York 30 Nov. 1897. He was graduated from Columbia in 1839, was appointed tutor of Greek and Latin there in 1843, adjunct professor in 1845, professor of Latin in 1857, and of Greek in 1867. He was acting president of Columbia at the time of President Barnard's absence as one of the commissioners to the Paris Exposition in 1867, and again in 1888, and became dean of the School of Arts in 1894. He assisted Dr. Anthon in the editing of classical text-books, prepared a new edition of Liddell and Scott's Greek Lexicon, and co-operated on the seventh Oxford edition.

**Drive**, a course upon which carriages are drawn or horses driven, a road prepared for

driving. To be conveyed in a carriage; to travel in a vehicle drawn by one or more horses or other animals.

**Driver, Samuel Rolles**, English biblical scholar and divine: b. Southampton 2 Oct. 1846. He studied at Winchester, and New College, Oxford, was for some years a Fellow and tutor of his college, and from 1876 till 1884 a member of the Old Testament Revision Company. In 1883 he was appointed to the regius professorship of Hebrew at Oxford, at the same time becoming canon of Christ Church. Among his numerous works may be mentioned: 'A Treatise on the Use of the Tenses in Hebrew, etc.' (1874); 'Isaiah: His Life and Times, and the Writings which bear his Name' (1888); 'Notes on the Hebrew Text of the Books of Samuel, with Introduction on Hebrew Palaeography' (1890); 'Introduction to the Literature of the Old Testament' (1891), a work suited for popular reading, which has passed through a number of editions; 'Sermons on Subjects connected with the Old Testament' (1892); the Book of Leviticus (1891-8) in 'The Polychrome Bible,' with H. A. White; 'Commentary on Deuteronomy' (1895); 'Commentary on Joel and Amos' (1897); 'Commentary on Daniel' (1901). He was one of the editors of the 'Variorum Bible,' with various renderings and readings and valuable other aids to the study of the Scriptures, published by Eyre and Spottiswoode in 1880; and with Neubauer translated a series of Jewish commentaries on the 53d chapter of Isaiah. He is also joint editor of the 'Hebrew-English Lexicon of the Old Testament.'

**Driver-ant**, a nomadic predatory ant (*Anomma arceus*) of western Africa, which makes its forays in column-like masses, driving other animals in fear before it, and forcing the negroes out of their villages.

**Driving.** Driving vehicles or riding furiously and recklessly in a public place, to the danger of the lieges, is an offense at common law in England, and may be prosecuted as culpable neglect of duty according to the law of Scotland. It has, however, been made a statutory offense, and a long series of acts passed to regulate the misconduct of drivers of public carriages, under which prosecutions are now as a rule brought. In the United States, furious driving in cities generally is a misdemeanor punishable by fine and imprisonment. In the absence of State laws, municipalities regulate the rate of driving. In most cities pedestrians have the right of way at street and road crossings. See also COACHING; RIDING.

**Drogheda**, *drōh'ē-dā*, Ireland, seaport in the southeast of county Louth; on the river Boyne, four miles from its mouth; 32 miles north of Dublin, and 81 miles south of Belfast. In 1494, the Irish parliament, then in session at Drogheda, passed under compulsion, the "Poynning's laws," sometimes called the "Statutes of Drogheda." In 1649, Cromwell stormed the city and massacred the garrison. William III. took possession of the city the day after the "Battle of the Boyne." Pop. 11,873. See POYNING'S LAWS.

**Drohobycz**, *drō-hō'bīch*, Austria, town in Galicia, 41 miles south-southwest of Lemberg. It has an important trade, chiefly with Hungary, in corn, leather, linen, earthenware, and particularly salt, obtained from salt springs in the



## DROITWICH — DROPSY

vicinity. Near the town are valuable iron mines and pitch wells. Pop. 17,784.

**Droitwich**, droit'ich, England, a market town, six miles northeast of Worcester, on the banks of the Salwarp. Droitwich is supposed to have been the Salinæ of the Romans, and some Roman remains have been discovered. It is still famous for its brine springs, rising near the centre of the town through strata of red sandstone and gypsum, and from which, as appears from grants to the church of Worcester, salt has been manufactured for more than 1,000 years. Pop. 4,256.

**Drôme**, drôm, France, a department, covered almost throughout by ranges of the Alps, the average height of which, however, does not exceed 4,000 feet; area, 2,518 square miles. Wines, olives, chestnuts, and silks are staple productions. Valence is the capital. Pop. (1901) 294,704.

**Dromedary**, the name of an improved variety of the one-humped camel (*Camelus dromedarius*), especially bred for riding owing to its extraordinary fleetness and power of endurance. It is able to travel at the rate of nine miles an hour, for many hours, without rest or food. Its ordinary gait is a trot; if forced to gallop, it soon gives up. See CAMEL.

**Dromgoole, William Allen** (Miss), American author: b. Murfreesboro, Tenn., 26 Oct. 1860. She was for several years engrossing clerk in the State capitol at Nashville, and after teaching school in Tennessee and Texas for a few years, took up the literary work in which she has since been engaged. She has written: 'The Heart of Old Hickory' (1895); 'Valley Path' (1898); 'The Farrier's Dog and His Fellow' (1899); 'Three Little Crackers from Down in Dixie' (1898); 'Rare Old Chums' (1898); 'A Boy's Battle' (1898); 'Cinch, and Other Tales of Tennessee' (1898); 'The Moonshiner's Son' (1898); 'Harum-Scarum Joe' (1889); 'The Battle on Stone River' (1899).

**Dromios**, The, two characters in Shakespeare's play the 'Comedy of Errors.' They are twin brothers of close resemblance, who had been separated early in life, and who meet as the respective attendants of Antipholus of Ephesus and Antipholus of Syracuse.

**Drone**, Eaton Sylvester, American journalist: b. Zanesville, Ohio, 25 Jan. 1842. He was graduated at Harvard 1866; was admitted to the New York bar in 1869; became the New York *Herald's* staff writer on legal subjects 1880, and later was made editor-in-chief of that paper. He has published: 'Law of Property in Intellectual Productions, in Great Britain and the United States, embracing copyright in works of Literature and Art, and Playwright in Dramatic and Musical Compositions' (1879).

**Drone**. See BEE.

**Drone-fly**, a dipterous insect (*Eristalis tenax*) of European origin, but first described as an American fly in 1870. It prevails from the Atlantic to the Pacific, and so closely resembles the honey-bee in size and color, that the two are often confounded. Living on the juices of flowers, particularly upon those of agreeable fragrance, it hovers about dwellings and windows late in the autumn.

**Dron'go**, or **Drongo-shrike**, a passerine bird of the family *Dicruria*, represented by many

species in Africa, Southern Asia, and Australia. The typical and most familiar species is the Indian *Dicrurus ater*. Of a glossy black color, it has the stout, hooked bill and forked tail of the shrike. Its food consists of insects, which it often captures on the wing. In India it is a common bird, where by Europeans it is called "king-crow" from its habit of routing crows and other large birds in defense of its nest.

**Drongo Cuckoo** (*Surniculus dicruroides*), an East Indian bird of the order *Picariæ*. It is especially interesting to biologists as a conspicuous example among animals of imitation, according to which one group of animals gradually assumes some characters of another and a different group, when such features are advantageous. Structurally, the drongo cuckoo is true to the picarian order, having the yoked toes—two in front and two behind,—and resembles the cuckoo, of the same order, in its habits of nesting and of egg-laying. But in other respects it exactly imitates the drongo-shrike, having the same description of plumage and color, with the furcated tail, and inhabits the same locality.

**Drontheim**, drönt'him. See TRONDHEIM.

**Droogenbroeck, Jan van**, yän vān droo'-gën-brèk, Flemish poet: b. St. Amand-on-Scheldt 18 Jan. 1835. He was long an educator of eminence, and issued his first verse collection, 'Ghazels and Makames' (Arabian terms for stanzas and songs) in 1866, under the pseudonym of JAN FERGUNT; his subsequent volumes, on Camoens and other important subjects, fully sustaining his reputation.

**Droppers, Garrett**, American educator: b. Milwaukee, Wis., 12 April 1860. He was graduated at Harvard 1887, and later studied at the University of Berlin 1888-9. From 1889 to 1898 he was professor of political economy and finance in the University of Tokio, Japan. He was secretary of the Asiatic Society of Japan and contributed to its 'Transactions' several important and valuable articles on Japanese currency questions. Since 1898 he has been president of the University of South Dakota at Vermilion, S. D. He has published a 'Translation of Schopenhauer's Essays' (1881).

**Dropsy**. This is a symptom rather than a disease. It consists of an accumulation of fluid in the subcutaneous tissues and serous cavities of the body. A number of localized forms of dropsy have received special names, such as dropsy in the abdomen—ascites; dropsy of the chest, hydrothorax; dropsy of the testicle, hydrocele; dropsy in the brain, hydrocephalus. The terms œdema and anasarca are also used as somewhat synonymous with dropsy; œdema meaning, however, more of a puffiness of certain portions of the body, and anasarca signifying a generalized and widespread dropsy. The main causes for the symptom known as dropsy are (a) insufficient strength of heart-action, allowing the serum of the blood to wander outside the blood vessels, and (b) some obstruction, preventing the return of the blood to the heart. The most important cause of dropsy is some disease of the heart and blood vessels whereby there is either increased forward or arterial pressure, or increased backward or venous pressure. The latter is of more importance

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than the former. Some vital alteration in the walls of the capillaries is important in bringing about the phenomena. The treatment of dropsy is technical to a high degree, inasmuch as the causes are frequently obscure. See **HEART DISEASE**.

**Drop'wort**, a plant belonging to the natural order *Rosaceæ*. It has pinnate leaves with serrated segments, and in habit resembles the meadow-sweet (*Spiræa salicifolia*), from which it may be distinguished by its scentless flowers and its different habitat. It was formerly included in the same genus, but is now assigned to *Porteranthus*, so named after Prof. T. C. Porter. It is known also as bowman's root. The hemlock dropwort, or water dropwort, is *Oxypolis rigidus*, an umbellifer growing in swamps from New York to Florida, and westward to Minnesota, and Louisiana. It is poisonous.

**Droseraceæ**, drös-ē-rā'sē-ē, the Sundew family, marsh plants, and natives of temperate and warm climates. The family has six genera, and about 125 species, known throughout the world. Among members of the family are Venus flytrap (*Dionæa muscipula*) (q.v.), and Parnassia. The family is represented in America by the typical genus of the order *Drosera*, which has about 110 species, most abundant in Australia. Seven species of the sundews are found in various parts of North America.

**Drosky**, drös'kī, **Droshky**, or **Droschky**, a kind of very small, light, four-wheeled carriage used by the Russians. It is not covered, and in the middle there rises a sort of bench placed lengthways. When there is only a single person in the drosky he generally throws one leg on each side of this bench, but the conveyance is also capable of holding two persons. The wheels are covered with wings, which keep off the mud. The term is now applied to several other kinds of vehicles.

**Drosom'eter** (from the Greek *drosos*, dew, and *metron*, a measure), an instrument for ascertaining the quantity of dew which falls. It consists of a balance, one end of which is furnished with a plate fitted to receive the dew, the other containing a weight protected from it.

**Drossinis**, drō-sē'nes, **Georg**, Greek poet: b. Athens 21 Dec. 1859. He has published five volumes of lyrics: 'Spiders' Webs' (1880); 'Stalactites' (1881); 'Idylls' (1885); 'Straw Flowers' (1890); 'Amaranths' (1891); also some stories and other minor works in prose. A charming simplicity of language characterizes all his works.

**Drouais**, Jean Germain, zhōn zhâr-măñ droo-ă, French painter: b. Paris 25 Nov. 1763; d. Rome 13 Feb. 1788. He was a pupil of David and having gone to Rome to study was, in 1784, successful in carrying off the great prize, his subject on that occasion being, 'The Canaanitish Woman at the Feet of Jesus.' His 'Dying Gladiator,' and particularly his 'Marius at Minturnæ,' on being exhibited in Paris, gained for him and David's school a new triumph.

**Drouet**, Henri, ōn-rē droo-ă, French naturalist: b. Troyes 1829. He early became known by his researches in natural science, and in 1855 published 'Énumération des mollusques terrestres et fluviatiles vivants de la France continentale,' due to his travels examining govern-

ment and private collections throughout France and his personal observations, which were extended in 1857 by a scientific journey through Portugal. He held a government position in the departmental administration from 1858 to 1870. The chief of his further publications are: 'Les mollusques terrestres et fluviatiles de la Guyane française' (1859); 'Sur terre et sur mer' (1870); and 'Alger et le Sahel' (1887).

**Drouet**, Jean Baptiste, zhōn băp tēst droo-a, **Comte d'Erlon**, French marshal: b. Rheims 29 July 1765; d. Paris 25 Jan. 1844. His conduct in the Peninsular war was highly distinguished. After the fall of Napoleon he was arrested on the charge of conspiring against the royal family. On the return of Napoleon from Elba he contrived to seize the citadel of Lille, in which he had been imprisoned, and held it for the emperor, who made him a peer of France. At the battle of Waterloo he commanded the 1st corps d'armée. After the capitulation of Paris he fled to Bavaria, where he resided till the July Revolution, when he returned to France, and received in 1832 the command of the army of Vendée. During 1834-5 he held the office of governor-general of Algeria, and in 1843 was elevated to the rank of marshal.

**Drouët**, Robert, American actor and playwright: b. Clinton, Iowa, 1870. He began his theatrical career at the age of 16, and a few years later headed a company of his own in which he played leading Shakespearean roles. He has been leading man in Chicago and Philadelphia stock companies, and has played leading parts with various prominent actors. The plays he has written are: 'Doris'; 'The White Czar'; 'Montana'; 'To-morrow'; 'An Idyll of Virginia'; 'Fra Diano'; and 'Captain Bob.'

**Drouyn de Lhuys**, Édouard, ā-doo-ăr droo-ăn dē lū-ēs, French statesman: b. Paris 19 Nov. 1805; d. there 1 March 1881. In 1840 he was placed at the head of the commercial department under the minister of foreign affairs, and shortly after was elected deputy for Melun; but he afterward was deprived of his office because of his opposition to the government. Under Louis Napoleon's presidency he became minister of foreign affairs. After the *coup d'état* he became one of the vice-presidents of the Imperial Senate, and again minister of foreign affairs. Being disappointed at the issue of the Vienna conferences in 1855, he resigned his office. In 1863 he was recalled to his old post, resigning again in 1866.

**Drown**, Thomas Messinger, American scientist: b. Philadelphia 19 March 1842. He was graduated at the University of Pennsylvania in 1862, studying later at Yale, Harvard, and Heidelberg. From 1874 to 1881 he was professor of chemistry at Lafayette College, and from 1885 to 1895 at the Massachusetts Institute of Technology. Since 1895 he has been president of Lehigh University.

**Drowning**, a form of asphyxia induced by submergence in water or other fluid. As a rule in drowning the body is submerged, but Peterson and Haynes in their recent 'Legal Text-book' relate the case of an epileptic patient who, while walking on a low, sandy beach, fell in a paroxysm with his face down, causing by his spasmodic movements a small excavation of an inch

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and a half in depth in the sand beneath his face. This small depression filled with water and he was found dead from asphyxia about an hour or more after the occurrence. Most cases of drowning result from asphyxia, by which is meant the body becomes poisoned from the lack of oxygenation of the blood, since no oxygen can enter the lungs from the fluid, in a form that can be utilized. Heart failure sometimes occurs in drowning. At one time drowning was a legal method of execution and prevailed in England until the early part of the 17th century; it was much practised in other European countries some years later. It is a frequent method of suicide, fully one third of the cases taking this method. Danger from drowning to swimmers depends very largely upon the ability of the swimmer, although this is not a guarantee of safety, since many excellent swimmers have been known to be unable to sustain the fatigue of being long in the water, and sometimes succumb suddenly from muscular cramps or from attacks of syncope. Persons who have respiratory defects, such as asthma or stammering, or who have organic disease of the circulation, are more liable to drown. Drowning occurs more often among men than among women, because of the greater amount of exposure. Extreme coldness of the water seems to be an important factor in augmenting the danger from drowning. Good health, muscular vigor and calmness of mind are of great importance in cases of danger from impending drowning. With reference to the symptoms there is great variability. Some people who have been submerged suddenly, and in water of low temperature, are found dead on almost immediate rescue. Here probably the nervous shock and deficient heart action accounts for the result. In a great many more cases, however, there is spasmodic closure of the glottis from direct irritation of the water as it enters the nose and mouth, and from nervous reflexes due to sudden chilling of the surface. Many of these patients sink to the bottom at once and remain below the surface, unconsciousness occurring in the course of a few seconds. The respiratory movements are few and convulsive and the heart stops. In the greater number of cases, however, asphyxia results from the entrance of water into the lungs; the individual struggles to come to the surface and as soon as the surface is reached attempts are made to fill the lungs by long inspirations. This very frequently draws a small amount of water into the larynx and then involuntary convulsive efforts result. With each convulsive inspiration more water is drawn in and thus pulmonary congestion becomes more and more pronounced. The struggle for life becomes violent and the patient frequently grasps at everything in sight, even tearing handfuls of mud from the bottom of the body of water. During the convulsive seizures the face becomes blue, the eyes bulge, the features become contorted, the pulse rapid and feeble. Ofttimes the bladder and rectum are emptied. After a few minutes, five or six, respiration ceases; four to six minutes more, sometimes longer, the heart continues to beat, gradually failing in strength and rapidity.

Treatment of all cases of drowning should be insistent and prolonged. If there is a great deal of water in the chest, the chances are lessened. Instances have been recorded in which

patients have been submerged 20 or 30 minutes and have recovered, but if the body has been beneath the surface for over 4 or 5 minutes the general chances of resuscitation are slight. If attempts at resuscitation are made,—and they should always be made unless the body has been under water several hours,—the body should be placed face downward, the head and shoulders depressed, so as to favor drainage of water from the lungs, and all efforts should be directed at first toward the restoration of breathing. The application of hartshorn, smelling salts, or snuff to the nostrils, tickling the throat with a feather, dashing cold water and hot water alternately on the chest and face, and vigorous friction of the upper part of the body to create warmth are of value, as also wiping and cleansing the mouth; surrounding the patient with hot bottles; and hot rectal irrigations of salt solution or whiskey. If these preliminary efforts fail, artificial respiration should be resorted to and continued for several hours. The patient should be still kept face downward, a folded coat or other article of dress raising and supporting the chest. The weight of the body on the chest forces the air out, then turning the body well over but gently on one side, then turning it on its face again, repeating these movements about 15 times in a minute, occasionally varying the side, at each turn and relief of the chest pressure, air enters the lungs and excites breathing. This operation should be assisted between each turn of the body, by brisk and uniform pressure between and below each shoulder-blade. At the same time, but without interfering with these operations, the hands and feet should be dried, wet clothing removed, and the body enveloped in warm blankets or re clothed with dry garments. Should these efforts prove unavailing after from two to five minutes, recourse should be had to Dr. Silvester's method, which consists in placing the patient on the back, on a flat surface inclined slightly upward from the feet, the head and shoulders being raised and supported on a small cushion, or folded article of dress placed under the shoulder-blades. The tongue should be drawn forward, and fastened by an elastic band, string, or tape over the tongue and under the chin, to keep it projecting beyond the lips. Then to imitate the movements of breathing and to draw air into the lungs, stand at the patient's head, grasp the arms just above the elbows, and draw the arms steadily upward above the head, keeping them stretched upward for two seconds. To expel the air from the lungs, turn down the arms and press them firmly for two seconds against the sides of the chest. Repeat these movements deliberately and persistently about 15 times a minute, until a natural effort to breathe is perceived, when the efforts should be turned toward inducing circulation and warmth, which can be best promoted by briskly rubbing the limbs upward with flannels, etc., thus propelling the blood along the veins to the heart, and by the application of hot flannels, hot water bottles, heated bricks, etc., to the pit of the stomach, between the thighs, the armpits, and to the soles.

Another method which has the advantage of simplicity and can be applied by one person is that of Dr. Benjamin Howard of New York. The body is placed face downward with a roll of clothing under the stomach, one arm being bent upward so that the hand supports the fore-

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head. To expel the water from the chest, the body is pulled feet downward over the roll of clothing. Then turn the body on the back, with the roll of clothing under the shoulders, so that the head falls back, thus stretching the neck. Kneel over the body, one knee pressed firmly against either thigh. With both hands spread over the lower part of the chest, so that the thumb hooks in under the lowest ribs on each side, press forward steadily with the weight of the body on the arms, thus raising the ribs, enlarging the chest cavity, and causing the air to enter. When the ribs have been pushed upward to their utmost extent, release them gently by a receding movement, allowing them to return to their original position, thus expelling the air. Repeat this process until respiration is restored, then resort to the methods already mentioned to induce circulation and warmth. No attempts at resuscitation should be abandoned until all efforts seem to be absolutely futile. See ASPHYXIA.

**Drowsiness.** See SLEEP.

**Droylsden**, droilz'dĕn, England, town in Lancashire, just east of Manchester. It contains large cotton manufactories, copperas, chemical, and dye works, and print mills. Pop. (1901) 11,087.

**Droz, François Xavier Joseph**, frāñ swā ksāv-ĕ-ā zhō-zĕf drō, French moralist and historian: b. Besançon, France, 31 Oct. 1773; d. Paris 5 Nov 1850. In 1806 he published 'An Essay on the Art of Being Happy,' which was very popular; and in 1823 'Moral Philosophy, or Different Systems of the Science of Life,' which procured his admission into the Academy. His reputation is, however, founded chiefly on his 'Histoire du Règne de Louis XVI.'

**Droz, Gustave**, French novelist: b. Paris 6 June 1832; d. 31 Oct. 1895. He was trained for a painter, but in 1864 gave up the pencil for the pen. The extraordinary success of his first volume of stories, 'Monsieur, Madame, and Baby,' justified the change. He excelled in little sketches of life and manners, and his lively, playful descriptions of bachelorhood and married life captivated the public. He has written: 'Sadnesses and Smiles' (1883); 'A Bunch of Letters'; 'At a Spring'; 'The Child'; etc.

**Droz, Henri Louis Jacquet**, ðñ-rĭ loo-e zhā-kā, Swiss mechanician: b. La Chaux de Fonds, Switzerland; d. Naples 18 Nov. 1791. He was a son of P. J. Droz (q.v.).

**Droz, Pierre-Jacquet**, pĕ-ār zhā-kā, Swiss mechanician: b. La Chaux de Fonds, Switzerland, 28 July 1721; d. Bienne, Switzerland, 28 Nov. 1790. Aspiring to be something more than a mere workman, he succeeded in attaching to common time-pieces, at a small expense, machinery which produced music resembling the chime of bells, and the music of a flute. His attempts to discover the means of effecting a perpetual motion led him to important discoveries. He contrived, among other things, a pendulum, which, being composed of two metals of unequal dilatibility, remained unaffected by heat or cold. He afterward made his celebrated writing automaton, which, by means of machinery contained within the figure, was made to move its fingers and hands, and to form handsome letters.

**Drug**, a name applied to all substances, vegetable, animal, or mineral, used for medicinal purposes, though the term should, perhaps, be strictly confined to what are called simples, balsams, gums, resins, and exotic products used as medicaments in a dry state. The name is also applied to dyeing materials and those used in tanning and other arts. See PHARMACY.

**Drug Habits.** See CHLORAL; COCAINE; HASHEESH; INTOXICATION; OPIUM.

**Drug Trade in America.** The development of the American drug trade shows a wonderful growth and a notable process of specialization, for a century ago a large part of the wholesale druggist's stock consisted of glassware, oils, paints, putty, indigo, and madder, whereas now it is confined to true drugs or medicines to an increasingly large degree. America's part in the history of drugs begins, however, before the American drug trade. One of the chief advantages which the world derived from the discovery of America, according to the learned men of that day, was the introduction of new and powerful drugs. For a long time, tobacco, sassafras, and Jesuits' bark were commonly used medicaments. All the old chroniclers dwelt much upon the health-giving qualities of American herbs. Everything that grew here was tried.

Throughout the whole history of medicine and pharmacy may be found a like faith in "patent," or more properly the secret, medicine. Their early pretensions had diminished by the beginning of the American trade, but there was still more natural faith in the community than now, of which the makers of patent medicines availed themselves, and their preparations formed an important item in drug stocks. But aside from patent medicines, which were characteristic of the times and the credulity of the people, the drug business had a much sounder basis for existence and progress. Staples, legitimate drugs, were gathered from all quarters of the globe, and as widely redistributed. The development of American commerce was apparent in this branch of commercial activity. Drugs, such as jalap, ipecac, sarsaparilla, and balsams, imported from Mexico, Central and South America, were exported largely to Europe from New York. In 1820, through French investigation, the separate alkaloids in cinchona bark were determined, and Pelletier shortly after began their manufacture. About the same time John Farr started a quinine factory in Philadelphia, which was followed at a later day by the building of another in New York by John Currie. The first supplies of cinchona bark came through Spain, but when the ports of South America were opened to our commerce shipments were received direct. For a certain period, while the government continued to tax foreign-made quinine, American manufacturers were able to supply the entire home consumption; but with quinine admitted to our free list in 1879, and the lower cost of manufacture abroad, the foreign makers were enabled to ship their surplus stock to this country. They soon secured a foothold in our market, and now supply more than one half the quinine consumed in the United States. Stone-oil or Seneca-oil, now known as petroleum, was first found in West Virginia, where it rose to the surface of the ground, heavy and dark; it was locally popular

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as a liniment. In 1829 a well was drilled in Cumberland County, Ky., which yielded a quantity so large as to be then considered a phenomenon. The bulk of it was wasted, but a little was bottled, and sold in Europe under the name of American oil. The device on the label—a derrick—first suggested a means of securing a sufficient supply of crude oil to pay for refining. From the first it was a medicinal remedy, and later the filtered paraffine residuums have proved valuable, and are known as petrolatum, vaseline, etc. These also have become articles of export, introduced abroad presumably by the demand from our own citizens visiting or residing there.

The earliest mention of the manufacture of drugs in this country is in the instructions given to Sir Francis Wyatt, governor of Virginia, in 1621, to invite attention to the making of oil of walnuts, and to employ apothecaries in its production. The inhabitants were likewise to search for dyes, gums, and drugs. The South Carolina Agricultural Society in 1785 offered premiums for the cultivation of drugs such as senna, cassia, rhubarb, hops, madder, and figs. But it is vain to attempt the description of individual articles and their employment in those olden days; a word or two may be said, however, of the business methods then current. In the retail branch it was largely "go as you please," and in the wholesale line, 60 years ago, the hours of business were from seven in the morning until nine at night. There were no railroads, and after the opening of the Erie Canal there was a rush of trade in the spring, and again before the close of navigation, so that at such seasons clerks would often be at work until midnight. The selling terms were six months, or 5 per cent off for cash. Interest was charged after six months, and sometimes the Southern trade would take an additional six months when the cotton crop failed. But as banking facilities improved credits were shortened. With the outbreak of the Rebellion large amounts outstanding had to be canceled; but though many houses went out of business, comparatively few failures occurred among the wholesale trade. A perusal of the advertisements of wholesale druggists of 100 years ago gives the idea that their stock embraced a great variety of articles. Stocks of the present day are about as varied; but we find that the old articles of *materia medica* have been combined and presented in many new shapes, and these, in connection with the thousands of new articles, present to-day a list whose complexity of nomenclature can be equaled by few lines of trade. The extent of drug stocks of a century ago, compared with those of to-day, might be approximated by a comparison of one of the earlier pharmacopœias with the present edition of 1890. That of 1830 will, perhaps, reflect the condition of affairs for two or three decades previous to its issue. In it 272 articles of *materia medica* are mentioned, and 349 processes are given for preparations, making a total of 621 titles. The 'United States Pharmacopœia' of 1890 has 994 titles, and the 'National Formulary,' a semi-official work of almost equal practical importance, has 435, making a total of 1,429 articles or preparations which the apothecary is supposed to be ready to furnish upon demand.

The wholesale druggist of 50 years ago carried, as do his successors of the present day,

many articles not mentioned in the pharmacopœias of that time, and this feature of the business has so rapidly increased that reference to recent price-lists of prominent jobbing-houses shows an average number of 5,700 articles in the department of drugs, chemicals, oils, etc., and of 7,600 articles in the department of "patent" or proprietary medicines. If the vast number of articles known as "druggists' sundries" were included, the figures quoted might be doubled, and by including the large number of secret proprietary medicines with which the country is flooded, but which are confined to local trade and do not appear upon general price-lists, the figures upon patent medicines would also probably double; so that it seems fair to estimate that the drug trade of to-day handles 25,000 articles. One notable feature of the drug trade of to-day is the division of manufacturing into distinct departments. The retail apothecary a century ago prepared from the crude material the medicines required by the physician. To-day, while his knowledge must include an acquaintance with all processes, his convenience impels him to buy the greater portion of his stock in such a stage of manufacture as renders it ready for dispensing. This has caused the building up of the business of manufacturing pharmacy, developed most extensively during the last 35 years, and the partial development of the manufacture of chemicals.

A review of the drug trade would be incomplete without some data respecting the progress made in chemistry. Apart from the development of inorganic chemistry and especially the discovery of anæsthetics, the evolution of organic chemistry is one of the scientific triumphs of the latter half of the 19th century. The discovery by Wöhler in 1828 that urea could be manufactured artificially from isocyanate of ammonium was the first step in the synthetic production of organic compounds, for until that period chemists held that no organic compound was possible except through the medium of "vital force." Since 1828 innumerable compounds of an organic nature have been prepared synthetically, and many of them are of such importance that they are produced commercially in extensive quantities, as, for instance, alizarine, the chief coloring principle of madder root, of which perhaps \$15,000,000 to \$20,000,000 worth is manufactured annually; oxalic acid, formerly prepared from the juice of the sorrel, is now made at one tenth its former cost from sawdust and caustic soda; while salicylic acid, instead of being derived from oil of wintergreen, is now produced by the action of carbon dioxide upon carbolic acid and caustic soda. The chemist has not only been enabled to prepare many of the organic compounds in his laboratory, but during the past 20 years a vast number of new and interesting synthetic chemicals which plants and animals do not produce (such as antipyrine, exalgine, phenacetine, etc.) have been discovered. This number is continually increasing, and many of the compounds are of importance therapeutically, and of much interest to the druggist and the drug trade. All this progress, this discovery in allied science and labor, has of necessity exerted a powerful influence upon the drug trade, and contributed toward making it what we find it to-day. But other agencies have been equally operative and effective in molding and shaping it.



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Of the first in importance among these agencies in its direct effect upon the retail trade, and through it upon the wholesale branch, has unquestionably been the 'United States Pharmacopœia.' At the beginning of the 19th century drugs were usually handled in a way which would be far from reassuring to the invalid of to-day. Between 1810 and 1820, however, an authoritative agreement was made on the part of those dealing in and prescribing drugs, regarding the identity and purity of the various medicinal agents then in vogue, and in 1820 appeared the 'United States Pharmacopœia,' a work which has passed through successive decennial revisions up to the present time, and which is recognized as the standard in all the various manipulations of drugs and chemicals, from the identification of the crude material to its proper preparation for the use of the invalid. Although this great work is the result of what might be called private initiative or purely scientific devotion, and is essentially the work of a distinct professional class, it has received governmental recognition to such an extent that the statutes of most of the States recognize it as an authority in legally determining the purity of drugs sold; and as a contribution to the literature of applied science it receives the indorsement of the medical and pharmaceutical professions of all countries. Governmental inspection of imported drugs began between 1820 and 1830, largely because of the initiative of the new pharmaceutical colleges in Philadelphia and New York, and it is still carried on by the national government. The next step in the reform of American pharmacy was the additional legislation, which is known popularly as the "Pure Food and Drug Laws." At the present time such legislation is receiving much earnest attention from the press, the public, and the trade, and in keeping with it are the laws of the various States regulating the handling and sale of drugs, chemicals, and poisons at retail. As it becomes more apparent that skill and experience in handling such articles are necessary to the public welfare, this class of legislation receives increased attention. The first law of this sort was passed by Rhode Island in 1870, since which time all the States, with but few exceptions, have taken similar action. There is a lack of uniformity of detail in such laws, but in general they restrict the dealings in drugs and the compounding of prescriptions to those who are able to bring satisfactory evidence of their qualifications before a board of pharmacy, which is authorized to license those whom it deems qualified to engage in the business. The beneficial effect of such legislation is at present only partial; for upon the enactment of these laws, all already engaged in the business were allowed to continue without qualifying under the new conditions. There are still many in the retail trade whose qualifications have not been officially determined. But this is a condition which a few years will serve to set right.

Associations for the conservation and advancement of the material and professional interests of the drug trade have exercised a powerful controlling influence. The first organization was effected in the retail branch when, in 1852, 21 active men formed themselves into the American Pharmaceutical Association. The association holds annual meetings for the discussion of scientific questions, trade and educational matters, and has a membership of nearly 2,000. One

of the features of its work is the annual publication of its proceedings, which contains a review of the scientific progress of pharmacy. Other organized bodies in the retail ranks are the State pharmaceutical associations, the oldest of which is that of New Jersey, founded in 1870. There are at present such State associations throughout the country. In the wholesale drug trade a notable event of the century was the formation, in 1876, by many of the western wholesale firms, of an association named the Western Wholesale Druggists' Association, called into existence by the demand of the times. The Civil War caused expansion, which was followed by collapse and a general unsettling of all trade relations. To hold trade, competition became sharp, and concerns that had been doing a prosperous business found it impossible to make profits. A committee was appointed to try to put into effect what is now known as the "rebate plan." This system was planned and adopted by the proprietors of patent medicines and the wholesale druggists to enable the latter to get a fair profit on patent medicines, which they had formerly been obliged to sell on very close margins. Buyers had to sign a contract that they would maintain established prices, and by so doing were entitled to 10 per cent discount, or rebate, on the wholesale price; but should they sell at cut rates, they would be placed on a "cut-off" list and be debarred from buying from the proprietors. In 1882 many of the eastern druggists joined with those of the West at a meeting in Cleveland, and the name of the association was changed to the National Wholesale Druggists' Association. The following year its first meeting was held in New York. While the various committees have worked hard and reported annually on matters of trade interest, such as the national bankruptcy law, fire-insurance, legislation, credits, etc., the committee on rebates has really effected the most important change in trade matters. Up to that time there had not been more than a dozen large distributing centres in the United States; now, by the working of the rebate system, almost all towns of 50,000 inhabitants have one or more wholesale druggists, who are placed on an equal footing with the largest buyer, and each one supplies the retailers in his neighborhood. Another important factor in the growth of the drug trade in this country is the pharmaceutical press. It presents records of current scientific investigation and progress, and brings the members of the trade or profession into closer touch and sympathy. Prominent on the list are the monthly journals, the 'American Journal of Pharmacy' (Philadelphia), the 'Druggists' Circular and Chemical Gazette' (New York), 'Pharmaceutische Rundschau' (New York), the 'Western Druggist' (Chicago), the 'National Druggist' (St. Louis); and the 'New England Druggist' (Boston). Of semi-monthlies may be mentioned the 'American Druggist and Pharmaceutical Record' (New York), and of weekly publications, the 'Pharmaceutical Era,' the 'Shipping and Commercial List,' and the 'Oil, Paint, and Drug Reporter,' all of New York. In addition there is a considerable number of similar publications issued by various colleges and societies and by several prominent drug and manufacturing firms.

The growth in method has already been hinted at. A century ago the apothecary cut and



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rolled his pills by hand, and made his plasters with a "spreading-iron"; to-day machinery greatly simplifies these operations, and the manufacturing pharmacist by power-machines is enabled to turn out 100,000 pills per day, and plasters *ad libitum*. For making compressed tablets power-machines are used which turn out 500 tablets a minute. Seidlitz powders are mixed, measured, and put up in packages by machinery, and bottles are filled, corked, and labeled by similar means. Marvelous has been the progress in operative, manipulative pharmacy, and the benefit to the drug trade from the results of inventive skill is shown when we consider that the combined rating of 270 wholesale druggists and manufacturers of chemicals and pharmaceuticals is nearly \$50,000,000. Of these, 11 are rated at \$1,000,000 each; about 30 up to \$500,000 each; 37 at \$250,000 each; and the others from \$20,000 to \$25,000 each. There are eight large factories engaged in manufacturing fine chemicals, and over a dozen firms making pills and other pharmaceutical preparations on an extensive scale. Let us enumerate a few of the most noteworthy improvements: Fluid extracts, as constituting a class of pharmaceutical preparations, are essentially an American invention. They are made by percolation or displacement, a process in which the powdered drug in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it. The value of this process cannot be overestimated, as the progress made in pharmacy in America during the last half-century is largely due to the study and development of percolation, and the introduction of preparations which are the direct outgrowth of the process. Percolation was made official in the 'Pharmacopœia' of 1840, and has been continued in the various revisions of that work to the present time. None of the pharmacopœias preceding that of 1850 gives formulas for the preparation of fluid extracts; in that year only seven formulas were given; in 1860 the number was increased to 25, and in the edition of 1890 there are 88. This number does not at all represent the great variety of fluid extracts manufactured, for they have become almost as numerous as the vegetable drugs in popular use. Another innovation is the elixirs, which are aromatic, sweetened, spirituous preparations containing small quantities of active medicinal substances. The term "elixir," used by manufacturers as designating a class of pharmaceutical preparations, was introduced prior to 1840, but the first formula published under the name "elixir" for the use of the druggist did not appear until 1859. In the adaptation of labor-saving machinery to the manufacture of pharmaceutical preparations the American inventor has found a field worthy of his genius, and of the greatest importance to the pharmacist. A century ago the old-fashioned iron or stone mortar for powdering drugs was to be found in every pharmacy, and drug-milling was unknown. Iron and stone mills have been superseded by new machinery which has greatly improved the quality of the product and cheapened the cost of production. Among the most important innovations is the process of grinding by attrition. Rapidly revolving arms in a cylinder soon reduce the introduced substance to any degree of fineness desired. For substances more friable, the rumbler, a revolving cylinder inside of which are porcelain balls, works better, and it

requires very little attention. Centrifugals have also brought about great changes in chemical production, and percolators have displaced the wide-mouthed jar and stirring-stick.

Sugar-coated pills were first made in this country by the Tilden Company, of New Lebanon, N. Y. The popularizing of gelatine capsules as a means of administering nauseous remedies in a readily assimilable condition is largely due to American push and inventive genius. The process originally outlined for their manufacture was that of Mothes, of Paris. H. Planten & Son claim to have been the first to make and introduce them in the United States. In the early seventies the invention of improved machinery for their manufacture gave the industry a strong impetus, and the business became one of magnitude. Pure fruit-juices have become a very important article to the retail drug trade. For making "soda-water," fruit flavors from artificial essences were for a long time used, until more cultivated tastes required the natural flavors. The manufacture of these is now carried on on a large scale, and great quantities of fruits are thus utilized.

In special fields of manufacturing pharmacy the development of new ideas and processes has been equally prominent. Perhaps one of the most interesting of these special developments has been that characterizing the discovery, commercial exploitation, and rapidly increasing commerce in what are known as the digestive ferments, of which pepsin is the best known. In keeping with the crude speculative views of the ancients on all physiological phenomena, the most absurd theories were advanced to explain the process of digestion in the stomach. It was not until the first quarter of the 19th century had nearly elapsed that the correct conception of the nature and agencies of the digestive secretions and process was reached. In America the commercial importance of pepsin and the other digestive ferments is far greater than in any other country, and in America their value and practical usefulness as therapeutic agents and in the artificial digestion of foods have been most fully developed. It was an American surgeon, Beaumont, who made (1825-33) the famous classical observations upon the phenomena of digestion in the living stomach, which revealed the functions of the gastric juice and did much to stimulate and suggest the direction of subsequent inquiries. The active principle of the gastric juice was discovered by Schwann, 1836, and he gave it the name of pepsin; diastase was discovered by Payen and Persoz, 1833; the album-digesting ferment of the pancreas was described by Corvisart, 1857-8, but not accepted until confirmed by Kühne (1867), who separated the ferment and named it trypsin; the emulsive ferment was discovered by Eberle in 1834. The history of American commerce in pepsin practically begins with the introduction of Scheffer's pepsin in 1872. This was prepared by the simple and practical "salt" process, a great improvement over previous methods of obtaining the ferment from the stomach. In 1879 Fairchild introduced the original form of pepsin in scales, "free from added substance or reagents." The appearance of this pepsin of phenomenal strength, with the recognition of the fallacy of administering the ferment in the largely diluted form then in vogue, was the signal for great activity in the manufacture and improvement of

## DRUG TRADE IN AMERICA

commercial pepsins. The obvious importance of stomach digestion naturally directed attention chiefly to the stomach ferments, and the medicinal use of the digestive ferments still remains popularly identified with pepsin; yet the other digestive ferments, especially those of the pancreas, possess far wider scope of activity and are relatively of wider importance. Practical recognition and application of these pancreas ferments must fairly be attributed to Fairchild, who in 1880 introduced the *extractum pancreaticis*, containing diastase for the conversion of starch, trypsin for the conversion of albumin, the emulsifying ferment for the digestion of fats, and the milk-curdling ferment. Fairchild demonstrated the very remarkable practical value and adaptability of these pancreas ferments, especially in the artificial digestion of foods for the sick. In the preparation of infant foods both diastase and trypsin have been extensively employed. Because of the indigestibility of starch for infants, Liebig proposed that the farinaceous foods commonly used with milk as food for infants should first be predigested into soluble form by means of malt diastase. In 1884 Fairchild proposed a method of modifying and adjusting cows' milk to a resemblance of human milk in digestibility and composition. Fairchild's method is based upon the conversion of caseine, by means of trypsin, into the soluble and peptone-like bodies which give to human milk its peculiar digestibility, in contrast with cows' milk. Pepsin now appears in a great number of popular as well as official forms, and is prepared generally by pharmaceutical manufacturers everywhere. The only house in the world engaged, as an exclusive specialty, in the manufacture of the digestive ferments and predigested foods is in the United States. The digestive ferments occupy a brilliant position in modern therapeutics, and the progress of physiological chemistry suggests still further utilization of the animal organic principles, as recently shown in the successful and important treatment of disease by the thyroid gland.

The india-rubber porous plaster, which was the first improvement made on old methods of applying plaster masses to the human body, was invented by Dr. Shecut, a naval surgeon, who sold it to Thomas Allcock, who failed to make it a success, and sold out to Dr. Brandreth. There were a number of manufacturers of plasters doing business at that time, whose products were made chiefly of isinglass and resinous mixtures, the latter being spread on cloth and plaster skins. About 1867 Seabury & Porter commenced to experiment with rubber, in order to introduce a general line of improvements. In those days, and up to 1876 or 1877, many of the mixtures were in solution, and the plaster mass was spread on frames with a brush, then cut, and made porous. Seabury was the first who conceived and practically worked out the idea of the use of rubber in medicinal and surgical plasters.

Another distinctively American form of medication unknown to our forefathers was introduced in 1878 in New York by Dr. R. M. Fuller, under the name of "tablet triturates." These preparations are made by triturating the active ingredient with either plain sugar of milk or a mixture of sugar and milk and cane-sugar, forming the mixed powders into a paste and pressing the paste into tablets in appropriate molds. In

this way small quantities of potent remedies, such as alkaloids, concentrations, etc., could be administered in a convenient, palatable, and readily soluble form. The idea was a taking one with the medical profession, and manufacturers began to produce them upon an enormous scale. An idea of the magnitude of this work may be gleaned from the statement that a single manufacturer lists no less than 500 different varieties of these preparations.

These instances of development in individual lines prepare one for a presentment of statistics showing the magnitude of the commerce in which the drug trade is to-day engaged. One of the advantages secured by the organized trade bodies that have come into existence during the past 50 years has been the keeping of statistics and the recording of current history. If such organizations had existed a hundred years ago the work of the present compiler would be comparatively simple. Our government did not keep records of imports and exports of drugs prior to 1830, and even then the list comprised but few items. The exports of medicinal drugs from the United States were then stated as \$130,238. For the year ending 30 Sept. 1835, they were reported at about \$200,000, whereas 60 years afterward the exportations of medicines of all kinds amounted to about \$8,000,000. Of these, ginseng root alone amounted to 233,236 pounds, valued at \$826,713, all of which was exported to China. Our own continent and the West Indies have been the only fields for exports as far as the introduction of our manufactured articles is concerned. Except for a few specialties, Europe has taken our simples only. Probably tobacco was the earliest indigenous drug exported, and its consumption has so increased that it is now of sufficient importance to be classed by itself. Oil of peppermint, which we find quoted in 1804 at 50 cents per pound, for the past few years has been selling at from \$1.50 to \$3 per pound. It was first cultivated in New York State about 85 years ago, and has also been very successful in Michigan. A sudden drop of price about five years ago has restricted production, the crop of 1897, 251,000 pounds, being the largest ever reported. A very fair proportion of the crop, something like 100,000 pounds, being the maximum for a year, is exported.

Senega or snakeroot has become a popular drug. It was formerly found in the eastern States, but is now found in sufficient quantities to pay for digging only in Minnesota, Dakota, and Manitoba, except some small quantities that come from the South. This root was quoted at 25 cents 100 years ago. It went up to 60 cents but during the last five years has declined, until now it is at the old figure. The annual production is estimated at between 300,000 and 400,000 pounds, and about one third the amount now gathered goes abroad to meet the increasing foreign demand. *Serpentaria*, or Virginia snakeroot, as it is sometimes called, comes mainly from Texas. This was quoted in 1804 at 25 cents, and this is still very near the average price. A demand exists for it for export, as also for goldenseal, sassafras, and mandrake roots, damiana and lobelia herb, and slippery-elm bark; but of all the indigenous drugs exported, cascara-sagrada bark probably is the largest in quantity, although ginseng root doubtless leads in value. Borax, although not an

## DRUGGET—DRUID

article of export, has considerable importance as a home product. Formerly our supply came from England or indirectly from Italy. It was first discovered in California in 1856, and later in the deserts of Nevada; now these two States supply the country. Before 1872 borax sold at from 28 to 35 cents per pound; since then the increased production has brought the price down to between 5 and 8 cents per pound.

Although we are still large importers of drugs and chemicals, the reason for this is a purely economic one, or rather it is a matter of convenience. The natural resources of the United States will, when developed, furnish nearly everything in the way of medicines. Borax has been cited as an example, but there are many others, especially those materials which enter into the inorganic compounds, and which are easily accessible, such as quicksilver, iron, lead, copper, zinc, aluminum, sulphur, lime, potash, soda, gold, silver, manganese, etc. With a climate ranging from frigid to torrid, nearly all the medicinal products of the vegetable world could with proper care be propagated in this country. Experiments with camphor, cork, licorice, opium, olives, and other foreign plants have demonstrated this fact.

We have no data as to the number of druggists doing business in the United States 100 years ago; but though there are now 38,000 in the country, the New York directory of 1786 gives the names of only five. Effingham Lawrence was the druggist and apothecary to the Medical Society, a committee of which examined his store quarterly and certified that his drugs were genuine and his medicines faithfully prepared. Two wholesale drug houses of the present day were founded about a century ago, but only one continues under the original name, though quite a number date back 60 or 70 years. The principal houses of that day were Lawrence & Keese, J. A. & W. B. Post, Thomas S. Clark, John & William Penfold, John M. Bradhurst, R. & S. Murray, Silas Carle, John C. Morrison, and Olcott & McKesson. The firm of Schieffelin & Company, of New York, is the oldest house in the drug line continuing under the same name in this country. It was founded by Jacob Schieffelin in 1794, and has been continued by his descendants. The firm of Powers & Wightman, of Philadelphia, was established in 1818 as Farr & Kunzi.

The first drug store in Washington was opened in 1796 by Frederick Miller, but its location cannot now be identified. Of the firms who have been 50 years or more in business in that city there are now but four. The store of Z. D. Gilman was established in 1822 by Seth Todd, who was succeeded in 1842 by Z. D. Gilman, since whose death a few years ago the business has been conducted in his name for the widow. The present firm of Sheller & Stevens was established in 1828 by William Gunton, and through a series of successions is maintained now under the name just quoted. Whiteside & Walton's store was established early in the thirties, as was also Thomas L. Crockley's business, whose founder was George W. Sothoron. Probably the oldest drug house in the West is that of T. H. Hinchman & Sons, of Detroit, Mich. The earliest Chicago wholesale druggists of whom we have any record are the following, named in the order of establishment: Dr. Clark; Dr. Brinkenhoff, now Peter Van Schaack & Sons; Dr.

John Sears; Stebbins & Reed, afterward J. H. Reed & Company; F. Scammon & Company; and Fuller & Roberts, now the Fuller & Fuller Company. Among the many firms manufacturing medicinal chemicals worthy of mention are: Rosengarten & Son, Philadelphia; Charles Cooper & Company, New York; Charles Pfizer & Company, New York; Mallinckrodt Chemical Works, St. Louis; Larkin & Scheffer, St. Louis; Herf & Frerichs Chemical Company, St. Louis. One of the most recently established of the chemical manufacturing concerns is the New York Quinine and Chemical Works, Limited. Although this corporation was formed in 1886 only, the quality of its products has placed it in the front rank. It was the first in this country to make, on an extensive scale, caffeine, cocaine, aloin, and acetanilide, and is the second largest American producer of quinine and morphine.

The United States can boast of many extensive laboratories devoted to the manufacture of pharmaceutical preparations. A pioneer in this line was Dr. E. R. Squibb, who in 1854, as a passed assistant surgeon in the United States navy, organized and ran the United States Naval Laboratory, furnishing the medical supplies for the navy for three years. In 1858 he started the present manufacturing business. Other houses are the Tilden Company, Lebanon, N. Y. (one of the first); Billings, Clapp & Company, and the E. L. Patch Company, Boston; Sharp & Dohme, and the Burroughs Brothers Manufacturing Company, Baltimore; Henry Thayer & Company, Cambridgeport, Mass.; William R. Warner & Company, John Wyeth & Brother, and H. K. Mulford Company, Philadelphia; Parke, Davis & Company, and Frederick Stearns & Company, Detroit, Mich.; William S. Merrell Chemical Company, Cincinnati, Ohio; Eli Lilly & Company, Indianapolis, Ind.; Charles S. Baker & Company, and the Searle & Hereth Company, Chicago. Henry Troemner, of Philadelphia, was, as near as can be ascertained, the pioneer manufacturer of druggists' balances or fine scales. He came here in 1836 from Marburg, Germany, and started in business in Philadelphia two years later. At that time scales for druggists were made to order by jewelers, and were generally of hammered silver, and consequently very expensive. In New York the number of jobbing druggists has decreased, and much of the importing is now done through foreign agencies. Likewise all the leading manufacturers throughout the country have agencies in this city, which condition tends to divide up the jobbing business; but there is a population of 4,000,000 in its immediate neighborhood to be supplied, in addition to its still being the largest distributing centre for the whole country.

JOHN MCKESSON,  
*McKesson & Robbins, New York.*

**Drug'get**, a coarse and flimsy texture originally half silk and half wool, chiefly used for covering carpets. It was formerly extensively employed as an article of clothing by the poorer classes, more especially of females; but this and similar fabrics are now almost wholly superseded by cotton goods, which induce greater cleanliness, and are less liable to retain infectious and contagious poisons.

**Druid**, a member of the Celtic priesthood of ancient Britain and Gaul, which at the period of the Roman invasion, existed chiefly

## DRUID STONES—DRUM

in Brittany, and along the valley of the Loire; and in the island of Anglesey, in Wales, and in Ireland. Scattered throughout these regions, at Carnac in Brittany, at Stonehenge and Avebury in England, and numerous other localities, are the stupendous stone structures, known as cromlechs, menhirs, dolmens, kistvans, etc., ascribed by the older archaeologists to the druidical cult, and still popularly known as druidical temples and altars, but now assigned by scientists to prehistoric palæolithic and neolithic predecessors, although it is probable these megalithic monuments were used by the Druids in their mystic rites to impress the populace. Welsh tradition relates that the Druids entered Gaul from the Orient with the Celtic Kymric race, and their religious practices have been variously described as of Hindu, Persian, and Egyptian origin. Accurate knowledge of the sect is limited owing to their inviolable practice of not allowing their history to be written, all their lore being committed to memory, and all instruction being imparted orally. The best ancient and contemporary account of the Druids is that by Julius Cæsar, who thus describes them: "They attend to divine worship, perform public and private sacrifices, and expound matters of religion. A great number of youths are gathered round them for the sake of education, and they enjoy the highest honor in that nation; for nearly all public and private quarrels come under their jurisdiction; and when any crime has been committed, when a murder has been perpetrated, when a controversy arises about a legacy or about landmarks, they are the judges, too. They fix rewards and punishments; and should any one, whether a private individual or a public man, disobey their decrees, then they exclude him from the sacrifices. This is with them the severest punishment. The persons who are thus laid under interdict are regarded as impious and wicked people; everybody recoils from them, and shuns their society and conversation, lest he should be injured by associating with them. They cannot obtain legal redress when they ask for it, nor are they admitted to any honorable office. All these Druids have one chief, who enjoys the highest authority among them. When he dies, he is succeeded by the member of the order who is most prominent among the others, if there be any such single individual; if, however, there are several men equally distinguished, the successor is elected by the Druids. Sometimes they even go to war about this supremacy. At a certain time of the year, the Druids assemble on the territory of the Carnutes, which is believed to be the centre of all Gaul, in a sacred place. To that spot are gathered from everywhere all persons that have quarrels, and they abide by their judgments and decrees. It is believed that this institution was founded in Britannia, and thence transplanted into Gaul. Even nowadays, those who wish to become more intimately acquainted with the institution generally go to Britannia for instruction's sake.

"The Druids take no part in warfare; nor do they pay taxes like the rest of the people; they are exempt from military service, and from all public burdens. Attracted by such rewards, many come to be instructed by their own choice, while others are sent by their parents. They are reported to learn in the school a great number of verses, so that some remain there 20

years. They think it is an unhallowed thing to commit their lore to writing, though in the other public and private affairs of life they frequently make use of the Greek alphabet. . . . Beyond all things, they are desirous to inspire a belief that men's souls do not perish, but transmigrate after death from one individual to another; and they hold that people are thereby most strongly urged to bravery, as the fear of death is thus destroyed."

Besides being priests and teachers of religion the Druids appear also to have been adept astrologers and magicians, and were versed in the mysterious powers of animals and plants; the oak-tree, the mistletoe when growing on the oak, the vervain, the hyssop, and marshwort were held in especial reverence among them, and like the Romans, they drew auguries and prophecies from an inspection of the entrails of sacrificed animals, and from the flight of birds; their mysterious rites were usually performed in the depths of oak forests. The order was divided into three classes: vates or prophets, bards, and priests; with them were associated, but without sharing their prerogatives, three classes of prophetesses or sorceresses.

Before the advent of the Romans the autocratic powers of the priesthood aroused the antagonism of the warrior element of the tribes, and according to Cæsar, the latter had deprived them of much of their political power. The Druids exerted all their powers to oppose the Roman conquerors, and continually incited the people to rebellion, until they were driven out of Brittany into Wales, and finally gathered in the island of Anglesey, where they were attacked by Suetonius Paulinus in 61 A.D., and in 78 A.D. were utterly subdued and almost exterminated by Agricola.

**Druid Stones**, a name given in England and other parts of the country to weather-worn, rough pillars of gray sandstone which are scattered over the surface of the chalk-downs in England, in Scotland, and its islands, and which exist in great numbers in other countries; generally in the form of circles, or in detached pillars; it is not certain, however, that the Druids had any connection with these stones. See GRAYWETHER.

**Druids, United Ancient Order of**, a secret society springing from a club organized in London 1871, solely for the entertainments of its members. The popularity of the club soon led to the formation of a distinct order and provided with a ritual for initiations and a form of government founded on traditions said to have been preserved from the ancient Druids. There are now two independent bodies, the Ancient Order of Druids and the Order of Druids of England. The order was instituted in New York in 1833. In 1900 the order in the United States reported 16 grand groves, 395 subordinate groves, 16,782 members, and \$4,536,701 disbursed in benefits since 1847; benefits disbursed during last fiscal year \$214,034.

**Drum**, a musical instrument formed by stretching parchment animal skin over the heads of a cylinder of wood or over a bowl-shaped metallic vessel. There are three kinds of drums: (1) The long drum or bass drum with two heads, held laterally and played on both ends with stuffed-knob drumsticks; (2) the side-drum, having two heads, the upper one

## DRUM — DRUMMOND

only being played on by two sticks of wood; the lower head has occasionally strings of catgut stretched across its surface, and then it is called a snare drum; (3) the kettle-drum always employed in pairs. Of these (1) is the ordinary drum used by an infantry or marching band. It is employed mainly to mark the time, and also to increase the fortes. The big drum, or *grosse caisse*, of the modern orchestra, is a modification of the ordinary drum, with the diameter greatly increased, and the length of the cylinder lessened. It is struck on one side only. (2) Is the side-drum of the fife and drum bands. It is occasionally employed in the orchestra for special effects. (3) Are either the small kettle-drums of the cavalry band, played on horse-back; or the proper orchestral drums, larger in size, but similar in construction. They are generally tuned to the tonic and dominant of the composition in which they are used, but this rule is not without exceptions. The tambourine is a species of drum, consisting of a single skin on a frame or vessel open at bottom. The heads are tightened by cords and braces, or by rods and screws.

The drum was a martial instrument among the ancient Egyptians, as the sculptures of Thebes testify. Their long drum was like the Indian tam-tam, and was beaten by the hand. It was about 18 inches long, had a case of wood or metal, and heads of prepared skin, resembling parchment. These were braced by cords in a manner somewhat similar to the modern. The instrument was carried by a belt, and was slung behind the back on a march. The invention of the drum is ascribed to Bacchus, who, according to Polygænus, gave his signal of battle by cymbal and drum. It was, however, known in very early ages, and in some form or other among almost all nations.

**Drum**, a Celtic word common in Ireland and Scotland, signifying a knoll, ridge, or small hill, frequently found alone as the name of a village, farm, estate, etc., and often also as a prefix, as in Drumalbin, Drumderg, Drumlanrig, Drummoissie, etc. Irish geologists give the name to all elevations.

**Drumclog**, Scotland, a place in Lanarkshire, on the borders of Ayrshire, 16 miles southeast of Glasgow. In 1675 Drumclog was the scene of a battle in which the Covenanters defeated the Royalists. The battle is described in Scott's 'Old Mortality.' A monument marks the scene of the encounter.

**Drumfish**, or **Drum**, certain fishes of the family *Sciaenidae* (q.v.), so-called from the resonant sound which they produce in the water by forcing gas through the air-bladder. In the United States the name is especially applied to the following. The common drumfish (*Pogonias chromis*) which has a short stout body, numerous barbels on the lower jaw, and large pavement-like teeth on the pharyngeal bones. It is one of the largest of food fishes, though the flesh is not highly valued. The drumfish is common on sandy shores south of Long Island and is caught on lines thrown into the surf. By means of its powerful dentition the shells of the stoutest mollusks and crustaceans are crushed and their contents devoured. At times schools of drumfish create great havoc on oyster beds. The red drum or red-fish (*Sciaenops ocellatus*) is a smaller fish, weighing from 10 to 75 pounds,

and distinguished by the separate lower pharyngeal bones, the absence of mandibular barbels, and the eye-like spot at the base of the tail. It is one of the most important game and food fishes of the southern United States, especially in Texas. The black drum (*Sciaenops deliciosa*) is a closely allied dusky bluish species found in the warmer parts of the Pacific coasts of America. The fresh-water drum or sheepshead (*Aplodinotus grunniens*) is closely related to the common marine drumfish, from which it differs in the absence of barbels. It ranges from the Great Lakes, where its flesh is coarse and rank and of little value for food, to Texas, where it becomes a fine-flavored and important food fish. It sometimes exceeds 50 pounds in weight.

**Drumgoole**, John Christopher, American clergyman: b. Longford County, Ireland, 1828; d. New York, 28 March 1888. He was ordained a Roman Catholic priest in the United States, and in 1871 began an organized mission in New York for homeless boys. The work grew under his charge and he built in New York a home called the "Mission of the Immaculate Virgin," and established an industrial farm of over 600 acres on Long Island, all in the interest of homeless boys.

**Drumlin**, a smoothly rounded oval hill of boulder clay, or till, formed beneath the great ice sheets of the glacial period. Drumlins are most frequently found near what was the front of the ice sheet, and, by their peculiar form, are easily recognized. They are usually over half a mile long and from 100 to 200 feet high. Drumlins are of common occurrence in Massachusetts, particularly about Boston harbor, where some form islands. They are also abundant in western New York and in southern Wisconsin. Their method of formation is uncertain, though they plainly represent material gathered beneath the ice sheet and in some way piled up by it. See **DRIFT**; **GLACIAL PERIOD**.

**Drummer**, one of the members of a regiment whose office it is to beat the drum, to mark time for military exercises and marching. In all the branches of the army service he receives slightly more pay than a common soldier. The drummers of a regiment are under the control of the sergeant-drummer. Also, in the United States, the name is applied to a traveling salesman or one who solicits trade going from one town to another.

**Drummond**, Sir George Gordon, English soldier: b. 1771; d. 1854. He entered the British army as ensign in 1789; was staff-officer at Jamaica several years; on duty in Canada 1808-11, and promoted lieutenant-general 1811. He was again ordered to Canada as second in command under Sir George Prevost 1813; planned and effected the capture of Fort Niagara; planned the successful attack on Black Rock and Buffalo; led a combined military and naval force against Oswego and destroyed the American works and stores, May 1814. He was in command of the British forces at the battle of Lundy's Lane 25 July, and in August invested, but failed to capture, Fort Erie. In 1815 he was appointed governor-general of Canada.

**Drummond**, Henry, Scottish geologist and religious writer: b. near Stirling 17 Aug. 1851; d. Tunbridge Wells 11 March 1897. He was educated at the universities of Edinburgh



## DRUMMOND — DRUNKENNESS

and Tübingen; entered the ministry of the Free Church, and having devoted much attention to science, was in 1877 appointed lecturer on natural science in the Free Church College, Glasgow, being made professor in 1884. One of his most popular books was 'Tropical Africa' (1888), giving his own experiences in that part of the world. His most remarkable work, and the one by which his name became most widely known, is 'Natural Law in the Spiritual World' (1883), which has passed through many editions and been translated into various languages. This work was written with the object of showing that such scientific doctrines and theories as those associated with the name of Darwin and his followers were not incompatible with revealed religion. He was author also of 'Travel Sketches in Our New Protectorate' (1890); 'Pax Vobiscum' (1890); 'The Programme of Christianity' (1892); 'The Greatest Thing in the World'; 'The Ascent of Man' (1894). The last-named work is a semi-popular review of evolution theories which caused some controversy on its first appearance, mainly on account of its author's insistence on the recognition of altruism, or "the struggle for the life of others," as the most important factor in organic and especially in social evolution. His facile and fervid style of composition suited the tastes of large numbers of readers. See 'Life' by G. A. Smith (1898).

**Drummond, James**, English Unitarian theologian: b. Dublin, Ireland, 14 May 1853. He was educated at Trinity College, Dublin, entered the Unitarian ministry and was colleague of Rev. William Gaskell (q.v.) at Cross St. Chapel, Manchester, 1859-69. He became professor of theology at Manchester New College in 1869, succeeding Rev. James Martineau (q.v.) as its principal in 1885, and removing with the college to Oxford in 1889. He has published 'Spiritual Religion: Sermons on Christian Life and Faith' (1870); 'The Jewish Messiah: a Critical History of the Messianic Idea Among the Jews' (1877); 'Introduction to the Study of Theology' (1884); 'Philo-Judæus: or the Jewish-Alexandrian Philosophy in its Development and Completion' (1888); 'Via, Veritas, Vita' (1894); 'The Pauline Benediction' (1897); 'International Hand-books to the New Testament' (ed. by Orello Cone); 'The Epistles of Paul the Apostle to the Thessalonians' (1899); 'Life and Letters of Dr. Martineau' (with Upton) (1902).

**Drummond, Thomas**, Scottish inventor: b. Edinburgh October 1797; d. Dublin 15 April 1840. He went to Woolwich to receive special instruction in the duties of an engineer, and while pursuing his studies showed his inventive talent by devising a form of pontoon which recommended itself by its facility of transport as well as by its admirable adaptation to the immediate purpose for which it was intended. Having heard the incandescence of lime mentioned in a lecture, it struck him that the light produced by this incandescence might be advantageously applied to replace the Argand-lamps which were used in the surveys, and after devoting a good deal of attention to the subject, he found a means of effecting the desired object. (See CALCIUM LIGHT.) On the first occasion on which the light was employed, in the Irish survey, it showed the position of a station 66

miles distant. While on the same survey he invented a heliostat which has always been employed since in land-surveying, and with the aid of which observations can be taken at distances exceeding 100 miles. In 1835 he was appointed under secretary for Ireland, and in 1836 was chairman of a commission on railways in Ireland, and gave in a very valuable report of the proceedings of the commission. His services to Ireland were recognized by the erection of a statue by public subscription.

**Drummond, William**, of Hawthornden, Scottish poet: b. Hawthornden House, near Edinburgh, 13 Dec. 1585; d. there 4 Dec. 1649. He was educated at the University of Edinburgh and, retiring to his romantic seat of Hawthornden, gave himself up to the cultivation of poetry and polite literature. A dangerous illness fostered a serious and devout turn of mind, which was evinced by his first productions, 'The Cypress Grove,' in prose, containing reflections upon death; and 'Flowers of Sion, or Spiritual Poems.' He entertained Ben Jonson at Hawthornden for three weeks on the occasion of a visit which the English dramatist made to Scotland in the winter of 1618-19. To this visit a great deal of interest is attached from the fact that Drummond took notes of the conversations held with Ben Jonson, which were afterward published, though not till long after the death of both. They first appeared in the folio edition of Drummond's works in 1711. These notes were republished separately by the Shakespeare Society in 1842. As a historian, Drummond is chiefly remarkable for an ornate style, and a strong attachment to the High Church principles of the Jacobites. His 'History of the Reigns of the Five Jameses' was published several years after his death. He is now remembered only as a poet. Although tinged with the conceits of the Italian school, there is much genuine imagery and truth of feeling in all his poetry, but particularly in his sonnets, which are replete with tenderness and delicacy. See his 'Poems,' edited with memoir, by Ward (1894); 'Life,' by Masson (1873).

**Drummond Island**, the extreme west of the Manitoulin chain, in Lake Huron, belongs to Chippewa County, Mich. It measures 20 by 10 miles.

**Drummond Light.** See CALCIUM LIGHT.

**Drunkenness**, in law, is not considered an absolute defense, although in some cases, depending on the nature of the act, and to what extent the person was under the influence of intoxicating drinks, the offense, when committed by a drunken man, is changed to one of less severity. The general rule is, that if a person voluntarily, by the use of intoxicating liquors, deprives himself of his reason, he cannot offer it as a defense for acts which he commits while intoxicated. If the intoxication is carried to such an extent as to be a disease, such as delirium tremens, or *mania à potu*, a different question is raised, and, in the first case, it will reduce the offense and in the second case there are some decisions which go so far as to hold that it is a complete defense.

The general rule is that contracts made by a person under the influence of liquor are voidable and not void; so that if a person while intoxicated makes a contract under which some inno-



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cent third person, for value, acquires rights, the contract is binding on the person making it; although he was under the influence of liquor at that time. If a person makes a contract when so far under the influence of liquor as to be deprived of his senses, and the contract is so one-sided as to be unreasonable, the question of fraud may enter into the transaction. In cases where a person is tried for murder in the first degree, to prove that crime the evidence must show, according to the statute defining murder in the first degree, malice aforethought. Now it has been held that an excessive intoxication excludes the malice and only passion is shown and the crime is reduced below murder in the first degree. But the person accused must prove intoxication to such an extent that passion and not malice will be shown. Although if a person, while sober, makes all preparation to take a person's life, and then, before committing the crime, becomes intoxicated, doing an act when intoxicated which he was afraid to do when sober, it would be murder in the first degree. In cases of robbery, it is presumed the goods are taken with a felonious intent, but if the accused can prove sufficient intoxication, the felonious taking is not presumed. When a person is tried for an act and the defense is provocation, the amount of provocation to make a good defense would be less, when the person who gave the provocation was intoxicated than if he was sober and in his right senses.

**Drupe**, in botany, a simple, succulent stone-fruit composed of a single monospermous carpel, of which the carpellary leaf becomes fleshy at its external division, and ligneous in its internal division, as in the peach, cherry, plum, olive, etc. The stone which encloses the kernel is the endocarp; the pulpy, or succulent part, the mesocarp. In the horse-chestnut and cocconut, the mesocarp is not succulent, and in the date the endocarp is replaced by a membrane.

**Drury, Arthur**, English sculptor: b. London. His art education was obtained at the National Art Training School, South Kensington, and in Paris under Dalou. His principal works are 'The Triumph of Silenus' (1885); 'Circe' (1893); 'St. Agnes' (1894); 'The Age of Innocence' (1897).

**Drury, Dru**, English silversmith: b. 4 Feb. 1725; d. 15 Dec. 1803. He was devoted to the study of entomology and to collecting exotic insects, and published 'Illustrations of Natural History' (1770-82), with upwards of 240 figures of exotic insects. His 'Illustrations of Exotic Entomology' was edited in 1837 by Westwood, and appeared with nearly 700 figures by Moses Harris.

**Drury College**, a coeducational institution in Springfield, Mo.; founded in 1873 under the auspices of the Congregational Church. In 1902 the college had 20 professors and instructors, and nearly 350 students. The library contained about 30,000 volumes.

**Drury Lane Theatre**, a famous place of amusement in London, located in Russell Street, near Drury Lane. It was first opened in 1663, and was rebuilt by Sir Christopher Wren and reopened in 1674. It was again rebuilt in 1794. The present edifice was opened in 1812, with a prologue by Lord Byron, the advertisement for

which gave rise to the famous 'Rejected Addresses.' Garrick opened the theatre in 1747 with Dr. Johnson's prologue; and most of the great English actors have trod the boards which are now given over for the most part to pantomimes and spectacular pieces.

**Druses**, a people of Syria, scattered over an extensive tract of country lying to the south-east of Beirut, and south of the country occupied by the Maronites; or, more particularly, they occupy the southern parts of Lebanon and Anti-Lebanon (the slopes of Hermon), while considerable numbers also inhabit the Hauran (south of Damascus), where the mountainous tract occupied by them is now often designated the Druse Mountain. The total Druse population is estimated at from 75,000 to 85,000. In the northern districts occupied by them they are mingled with the Maronites, but many towns and villages are peopled almost exclusively by the Druses. There are some circumstances which tend to show that the Druses are not indigenous to the territory they now possess, although they have long since dropped their own language and adopted the Arabic. They were in Lebanon and Anti-Lebanon as early as the 11th century. The peculiar interest attaching to this people belongs, however, more to their political constitution and their religion than to their origin. Politically the Druses are divided into two parties, that called the Jumlatiehs, with the family of Jumlat at their head; and the Yezbekiehs, with that of Abou-Nakod at their head. These two parties live in almost constant strife, except when they have a common foe to contend against, when they forget their internal dissensions and unite their strength for offense and defense. Their religion is a curious mixture of Judaism, Christianity, and Mohammedanism. They believe in one God, who is the only being to whom worship ought to be paid. According to their religious books he cannot be defined by any of the qualities belonging to created beings. The doctrine of the unity of the Deity does not admit, in their view, even of the consideration of any quality or attribute existing in him. They profess to believe in the unity of God with the abstraction of every quality and mode of existence. The Druses also believe that God has at different times appeared to men in a human form, and that his last appearance was under the name of Hakem, of Egypt, who announced himself at Cairo as a divine incarnation about 1030 A.D. They therefore regard Hakem as God, and they believe that he will one day return to earth, cause their religion to triumph, and punish the unbelieving. They have neither prayers, fasts, nor festivals, and, with the exception of a privileged class, the Akals, or initiated, they have no worship. When they go among the Turks they behave as Mussulmans, and in the midst of the Christian community of the Maronites they enter the Christian churches, and imitate the Christian believers in the use of the holy water. The uninitiated, called Jahils, are exempt from all religious duties whatever.

The Druses have also a peculiar moral code. They have seven commandments, a number taken from the sacred writings of the Mohammedans. The following, according to Hamsa, are their seven commandments, or cardinal principles: (1) Truthfulness; (2) mutual defense; (3) renunciation of all other religions;

(4) separation from evil spirits and perverse men plunged in error; (5) recognition of the unity of God at all times; (6) contentment in all labors; (7) patience in all circumstances. At the end of the 16th century this people began to excite attention in Europe. In 1588 they were made tributary to Turkey by Amurath III.; but in the beginning of the 17th century recovered their independence under the renowned Emir Fakreddin, and reached the summit of their power; but this leader was in 1635 strangled at Constantinople, and although other princes were placed over them, they never recovered their former reputation. They endeavored, indeed, by the assistance of the Russians in 1773, to regain their freedom; but they were soon obliged to become again dependent on the Turks. Troubles have more than once broken out between the Druses and the Maronites, their neighbors. An outburst of this kind occurred in 1860, and fearful atrocities were perpetrated upon the unhappy Maronites, who, however, seem to have been also aggressive. About 12,000 Maronites were killed and a large number were driven from their homes. A French force was sent out, and by its intervention tranquillity was restored. Since then, under a Christian governor appointed by the Porte, the Druses have been quiet. This outbreak resulted in the government of Lebanon about as it is at present. See **LEBANON**; **MARONITES**; **SYRIA**. Consult: Oliphant, 'Land of Gilead'; Carnarvon, 'Druses of the Lebanon.'

**Drusilla**, a daughter of Herod Agrippa I., king of the Jews. She was only six years old at the death of her father, 44 A.D., but had been betrothed to Epiphanes, son of Antigonus, who, however, refused to complete the match because one of its stipulations bound him to become a Jew. Azizus, king of Emesa, being less scrupulous, obtained her for his wife, but had not possessed her long when she divorced him to marry Felix, procurator of Judea. She is thus the Drusilla who is mentioned in the Acts, and was probably present when Paul preached before Felix.

**Drusus, Marcus Livius**, Roman politician: d. 91 B.C. Rome was divided by the disputes of the senate and the equestrian order. Drusus endeavored to gain over the people to the party of the senate by the division of lands, to which the senate agreed with the utmost reluctance, and to gain the Roman allies by the promise of citizenship. He came forward, relying on this assistance, as a mediator between the hostile parties. He succeeded in this, notwithstanding the most violent opposition from both parties, but the jealousy with which each party guarded its rights, and the rash and violent manner in which Drusus had effected the union, rendered him unpopular with both parties. On his return to his house from an assembly of the people, accompanied by a number of the Latins, he was stabbed at his door by an unknown hand. His death was the signal for the beginning of the social war which had been so long threatening.

**Drusus, Nero Claudius**, Roman general: b. 38 B.C.; d. 9 B.C. He was the first Roman general who penetrated to the German Ocean. He became prætor (11 B.C.), but returned in the next spring to Germany, subdued many tribes as far as the Weser, and commenced the erection

of fortresses. On this account he was appointed proconsul; the army saluted him with the title of *imperator*, which was not, however, sanctioned by Augustus. In 9 B.C. he was made consul, but returned soon after to Germany, and penetrated as far as the Elbe. The canal uniting the Rhine with the Yssel (*fossa Drusi*) was his work; and the place called Drusenheim, in Alsace, where he encamped for some time, received its name from him. His son Claudius afterward became emperor.

**Dry Dock.** See **DOCK**.

**Dry-goods Trade, American.** In the beginning of the dry-goods trade in America textiles were so often combined with other commodities to form the merchant's stock in trade, that it was difficult to determine where one began or ended. Trading of all kinds was of a generalized character, merchants handling alike dry-goods, groceries, and sundries in the same establishments. The stocks represented in such stores were incongruous in the extreme; cottons and silks from India, and velvets and woollens from Europe, were placed in juxtaposition with groceries and hardware. Trade in textiles was almost entirely of an import character, and the wholesale merchants, as a class, were either directly or indirectly importers. The extent of American cloth manufacture, as a factor in commerce, was inconsiderable. There were then few specialized industries or departments in trade or traffic. The distaff, the spinning-wheel, and the hand-loom were part and parcel of nearly every well-regulated household. The flax and the wool were raised, carded, spun, and woven at home, and the same hands that performed these offices also frequently fashioned the fabrics into wearing apparel for the use of the family. This state of things, as a matter of course, applied more fully to the common people. The rich or more prosperous classes of the community then, as now, imported many of the articles which formed their wardrobes, as well as their bed and table linen. Comparatively little attention was given to the culture of cotton. Its manufacture in an organized way, like wool, was confined to one or two establishments of crude construction and operation. They produced fabrics of no great commercial importance, save that they served to mark the initial stage or starting-point for the greater multiplication and diversification which have followed.

When it is considered that the inventions of Hargreaves, Arkwright, Paul, Crompton, and Cartwright had barely been adopted in this country at the close of the 18th century, the development of our textile industries since is simply marvelous. At the time referred to, our home products represented, in woollens, a few coarse cloths; in silks, a few lace and braid sundries; and in linens, some coarse sheeting and toweling. Our imports of foreign textiles during the same period were also of moderate proportions, being probably about double the value of the home product. In fact, from the close of the Revolutionary War until 1795, our imports of foreign dry-goods averaged yearly about \$24,000,000 to \$26,000,000, while the value of the home product varied between \$12,000,000 and \$13,000,000. The latter, being almost wholly of household manufacture, had but little representation in merchants' stocks.

The village stores in those early days were

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few and far between, and where they did find location, their stocks, so far as dry-goods were concerned, represented only a few of the coarser textures in woollens, linens, and cottons, with buttons and thread, associated with supplies of rum, molasses, and groceries. A considerable trade with towns located on the banks of inland streams was transacted by means of flatboats similarly stocked. In the cities the wholesale trade was almost entirely confined to the importers, who dealt in those foreign and home commodities, crude or manufactured, which were in the greatest demand and yielded the best profits. With the retail trade in the cities likewise, the distinction in the kind of goods handled by different dealers was not very marked, most of the shopkeepers selling a little of everything. In some of the larger cities, however, a slight tendency toward separate classification began to appear; that is, dry-goods and notions, in the more pretentious establishments, were to some extent sold to the exclusion of other commodities. But the general condition of the people—the fact that they supplied themselves with the manufactures of the household and preferred in many cases to barter rather than pay the cash—did not tend to develop early any very large retail establishments in separate lines of goods, even in the most populous cities.

In this connection it may be interesting to note that the imports of foreign merchandise paying ad valorem duties into the United States from 1795 to 1800 inclusive, amounted to nearly \$212,000,000, of which the textile part represented about two thirds. The kind and character of the latter—especially at New York, which was then, as now, the chief importing city of the country—may be readily inferred from the following names. They represented goods chiefly from India and China, and the cities of Amsterdam, Hamburg, Liverpool, and London, such as cottons, woollens, silks, velvets, linens, laces, edgings, hosiery, gloves, and shawls, including damasks, dimities, callimancoes, durants, tabarets, platillas, listadoes, mamoodies, gurrachs, cossas, baftas, russets, satinets, duffels, britannias, etc. Among the more important firms in New York importing or handling such goods about 1800 were: Bethune & Smith, Murray's Wharf; John Knox, 97 Water Street; McCready & Reid, 97 William Street; Hector & Scott, 125 Pearl Street; John & William Tabele, 260 Pearl Street; Richard & John Thorne, 141 Pearl Street; Benjamin I. Moore, 103 William Street; Charles J. Vogel & Company, 92 Maiden Lane; William Blackstock & Company, 163 Pearl Street; A. S. Norwood, 127 William Street; Robert & John Sharp, 93 Maiden Lane. These firms, with the exception of A. S. Norwood, who dealt almost exclusively in carpets, rugs, and besides handled dry-goods more largely, perhaps, than other houses, although among the latter, who sold them in connection with other foreign and domestic commodities, might be mentioned: Archibald Gracie, 52 Pine Street; James Stuart, 10 William Street; Eben Watson & Company, 36 Old Slip; Ferguson & Crichton, 84 Broadway; Rogers & Lambert, 232 Pearl Street; H. G. Rutgers & Company, 145 Pearl Street; Rutgers, Seaman & Ogden, 93 Front Street; Thomas Bulkley, 241 Front Street; Suydam & Wyckoff, 21 South Street; Robert Weir & Company, 16 Gold Street; John Knox, 97 Water Street; Thomas

Warren, 61 Maiden Lane; John McGregor, 84 Broadway; and Minturn & Barker, Thomas Napier & Company, Robert Lenox, Frederic de Peyster, Gouverneur & Kemble, John Murray & Sons, and others.

From 1800 to 1815 the country, its trade and industries, passed through some very trying ordeals—complications arising with France, the Embargo and Non-Intervention Acts going into effect, and everything finally culminating in the war with Great Britain. The restrictions upon our import trade during this period tended rather to foster our home industries than otherwise. In 1803 a serious panic prevailed in Great Britain, which materially affected our trade interests both at home and abroad. In 1804 the first consignment, for sale, of American cottons was made by Almy & Brown, of Providence, R. I., to Elijah Warren, of Philadelphia, Pa., who became their agent for yarns and threads, and afterward for stripes, plaids, checks, gingham, tickings, etc. The amount of domestic cottons sold in Philadelphia, the produce of New England factories, from 1804 to 1806 inclusive amounted to only \$17,670.

The Embargo went into force in 1807, and as a matter of course, almost wholly cut off our foreign trade. The cotton-spindles in the United States at this date amounted to about 4,000, showing that the progress made in this line of industry had been slow, although before the end of the year they had doubled, and by 1809, 17 mills were in operation in Providence, R. I., and vicinity, working 2,296 spindles, and producing about 510,000 pounds of yarn. About 1,000 looms were employed in weaving cotton cloth. The census returns for 1810 also gave further evidence of more or less rapid advancement being made in the manufacture of cottons and woollens, as well as in other industries. In round figures, according to the Treasury Department, the value of our product in cottons and woollens, exclusive of clothing and other goods, in 1810 was nominally about \$46,000,000. The invention of the cotton-gin by Eli Whitney had brought about a great change in both the production and the manufacture of cotton, so that it became our leading textile product.

In the years 1815-16 imports of foreign dry-goods were so enormous as to glut the markets and paralyze cotton and woolen industries as well. In fact, many of the leading importing and other merchants of the time were almost ruined by the unprecedented fall in the prices of goods and the general stagnation of trade and business resulting. This state of affairs was not entirely due to the results of the war, and the reopening of our ports to foreign traders who took advantage of the low rates of the ad valorem duties then prevailing, but was caused largely by the cotton and woolen manufacturers of Great Britain who unloaded their surplus stocks in our markets at prices below the cost of production, with the view to cripple our textile mills and control the trade of this country. In this they succeeded for the time and for some years later. Through the decades ending with 1820, 1830, 1840, and 1850, there is but little reliable official information to be gleaned from the census reports respecting our advancement in manufactures, if the year 1850 be excepted; but that it was gradual and steady is evidenced by the increased production of the spindles and the looms, especially in cottons and woollens,

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distributed by the general dry-goods trade. Our imports of textiles also kept growing apace, but not in like ratio to those of home production. This long period was eminently one of preparation and organization for both our dry-goods and our general textile-manufacturing interests. Many important inventions and processes were perfected during this time, such as the sewing-machine, power-loom, knitting-machine, and other mechanical devices, which not only changed but multiplied and diversified the textile manufactured products of the world, and thus created many of the subdivisions which are such important factors in the dry-goods trade to-day.

The wars, panics, depressions, conflagrations, and other vicissitudes through which the trade and country passed in the first half of the century seemed to spur manufacturers and merchants to make renewed efforts in the upbuilding of our industries. In the latter decade of it there set in a more marked tendency toward the diversification of products, and the inauguration of improved methods in their sale and distribution. The classification of goods was then carried to a much finer point than formerly, and the general trade, both wholesale and retail, outside of the regular dry-goods jobbing houses, began to make more or less separate distinctions in the goods which it sold. There were importers and wholesale dealers who handled special or distinct lines of goods, as silks and dress-goods; cloths, coatings, and cassimeres; notions and small wares; hosiery, underwear, and gloves; laces and embroideries; white goods and linens; and hats and caps. In the retail trade in the cities these distinctions, in many cases, were equally well outlined, although the stores in the larger towns and villages throughout the country still adhered more or less closely to the original policy of carrying miscellaneous stocks of merchandise. The evolution of the clothing trade, and, still later, that of made-up articles for women's and children's wear, not only brought the immigrant garment workers to the front in these particular lines of trade, but also, in the succeeding decades, made the classifications in manufacturing, wholesale, and retail circles still more minute and numerous. If there be added to these the development and more general utilization of the commercial agency and the commercial traveler systems, we have the grand factors in the extension and prosperity of the dry-goods trade of to-day. Indeed, when the year 1850 dawned we had reached the basis on which to build a broader national and industrial development. With the founding of new towns and cities in the interior, west and south, there came a larger and more diversified demand, with an increase of stores and shops, while newer and more varied articles of merchandise, suitable to the growing wants and tastes of the people, were being produced. In 1850 the value of our cotton and woolen products aggregated about \$112,000,000, while our combined textile output reached \$129,000,000. Our imports of foreign dry-goods for the same year approximated \$59,000,000. As compared with 1795, the former had increased about tenfold, while the latter had only about doubled. However, this is not altogether a fair showing, because the dry-goods trade handled large quantities of miscellaneous merchandise not strictly included in the textile class, which would largely

swell the total in sales, and make the increase in general distribution for the 55 years the more noteworthy and significant.

Thus it will be seen from the foregoing, that the year 1850 marked a new era in the history of the dry-goods trade of this country. Prior to it there was practically no domestic commission business done in New York. Boston, Philadelphia, and Baltimore were then the domestic commission centres. The product of the New England mills was mostly controlled by Boston houses. Philadelphia had 20 or more commission-houses selling all kinds of domestic goods, and it was the chief market for what were then designated as "blue goods," which comprised denims, checks, stripes, etc. Some of the Philadelphia houses were organized as early as 1832. About this time, also, a large quantity of dry-goods were sold in Hartford, Conn. New York was the market of this country for imported goods, and the importance of opening domestic commission-houses in that city then began to be recognized. At first the Boston merchants, agents of the Eastern mills, discouraged the project, and only a few of them were induced to open small offices in New York. Soon, however, it was found that in these small offices a larger business was being done than in the parent houses in the East, and so one house after another, and mill after mill, opened agencies in New York, and the business soon developed into extensive proportions. At this date the jobbing business of New York was still largely done downtown, on Broadway, Cedar, Pine, Liberty, and Broad Streets; there were no retail houses above Howard Street. Our home manufactures of textiles were still mostly of a common staple character, all the finer goods being imported from Europe.

In 1857 occurred the memorable panic, which for the time paralyzed the business of the country; and the dry-goods interest, being the largest and most diversified, suffered the most severely. A daily record of one of our New York houses, kept continuously from 1847 to the present time, notes 27 Aug. 1857, "the failure of the Ohio Loan and Trust Company, as the beginning of horrors." October of that year is recalled by all who took part in the struggle as a time which tried men's souls—and their bank-accounts. Numerous failures occurred, and many were the accounts of fortunate turns and of hairbreadth escapes from suspension and failure.

The imports of foreign dry-goods into the United States in 1860 amounted to \$112,350,000, while the value of our combined textile manufactures reached \$215,000,000. As contrasted with 1795, the former had increased nearly fivefold, and the latter nearly 18 times. It may be interesting to particularize some of the more important commercial and financial events during the Civil War which specially affected our dry-goods interests. In December 1861 cotton goods began to advance, and the average increase in prices during the first two years of the war was about 300 per cent. The following year showed a still sharper rise, and the high prices of the War culminated in the fall of 1864, when the average advance in prices of cotton goods from December 1861 was about 1000 per cent. In April 1864 raw cotton sold at \$1.90 per pound, and on 11 July gold reached 299. The period intervening between 1861 and 1864 was one of the sternest the mercantile world has ever

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known. In Europe it was known as the "cotton famine," regular shipments of the staple from the United States being almost entirely suspended. Gen. Lee's surrender occurred 9 April 1865, and on 30 June of that year cotton sold at 40 cents per pound. Manufactured cottons, however did not show proportionate decrease in price. In October following cotton had risen to 64 cents per pound, while prints, sheetings, etc., were about half the price which had been current for them in the fall of 1864. It was during this year that the largest dry-goods jobbing house, not only in this country, but in the world, distributed goods broadcast throughout the Union to the enormous amount of \$72,000,000. The imports of dry-goods in 1870 aggregated only \$98,290,000, while the value of the combined product of home manufacturers exceeded \$520,000,000. The increase, as compared with 1795, in imports was barely fourfold, while in home products it represented about 2500 per cent.

By 1880 the value of our textile products was nearly \$533,000,000, while our imports of foreign dry-goods approximated to \$136,000,000. The showing in this decade for home products did not exhibit a very large increase; still it must be borne in mind that our manufacturers encountered some very severe vicissitudes during this period, and besides, from the close of the War onward, there had been a gradual and steady decline in the prices of nearly all kinds and classes of textiles, due to the improving and cheapening of facilities for production. While the value of the output showed but little appreciable augmentation, the increase in quantity and variety was especially noteworthy. From 1881 to 1887 inclusive, Mulhall, one of the most reliable of foreign statisticians, estimates the aggregate value of the output of American textile manufactures at \$3,250,000,000, which would give an annual average value for the seven years of \$465,000,000. But he was considerably below the mark in his figures, since the output three years later (1890), according to the census reports, represented \$1,261,672,504, and in 1900 \$1,637,484,484.

But textiles only have so far been considered, and the dry-goods merchant of to-day, both wholesale and retail, handles multitudes of articles not included in that category which serve to increase his sales to a very large extent. Owing to the great subdivisions now existing in the trade, as well as to the fact that the large commission-houses, importers, jobbers, and retailers have intermixed dry-goods proper with many other lines of merchandise, it is utterly impossible to get at the exact value of the annual distribution. In fact, in the later decades of the century there has been a manifest disposition on the part of the large retail houses in our cities and more enterprising towns to buy and sell, like the early importers, promiscuous merchandise and wares in connection with dry- and fancy-goods proper. The census reports of the United States have divided the manufacturing industries into 363 classes, of which the dry-goods establishments of the present day contain not less than one sixth of the whole. In many of these stores are to be found nearly all the modern appointments and conveniences that serve to attract, please, and satisfy the wants of customers. The refectories, cash, delivery,

sample, mailing, and express systems are now some of the more prominent features of some of these establishments, which have patrons living thousands of miles away.

The wholesale departments have not lagged behind the retailers. The older importing and jobbing centres still maintain their due share of the country's trade, but it is centralized in fewer houses. The gain in trade and traffic by interior, western, and southern distributing centres represents no very material loss to the older eastern cities, from the fact that there has been in many instances such an unprecedented increase in the wants of the people of those sections, due to growth of population, geographical and other reasons, that the organization of wholesale distributing houses there became a necessity. An estimate of the textiles manufactured in this country during the past century, based upon the United States census reports and upon the figures of reliable statisticians, would place the aggregate value of the same at over \$20,000,000,000, while the imports of foreign dry-goods for the same period would probably represent one third of that amount, or nearly \$7,000,000,000. Adding to this total of \$27,000,000,000, the freight, insurance, exchange, and duties on the foreign part, and the sellers' profit on the whole amount as the goods reach the consumer, we would have the enormous aggregate of nearly \$40,000,000,000.

The present facilities for finding out the correct standing of "far-away merchants," not only as to their financial ability, but also as to their moral character, business habits, and general reputation, are so good that in adjusting credits space is in a great measure eliminated. Since the establishment of the first mercantile agency in 1841, these agencies have multiplied and improved so as to be of vast service in determining credits. While far from infallible, they are indispensable. The uniform courtesy existing between merchants in the exchange of references is also of great value, and with all the means of information now at hand the "far-off merchant" worthy of credit suffers no disadvantage by reason of distance from market. While rivalries exist, and rightly so, between merchants and between cities, it is worthy of note that petty jealousies are rapidly fading away. The development of this country is so great, and the interests of the people are so closely allied to one another, that anything affecting one part of the country affects the whole, and sectional differences and strifes are rapidly disappearing. The constant growth of this country in population, area, and wealth has a broadening influence upon the people.

In point of capital and labor employed, and magnitude of proportions, it has no equal. The tendency of this country to concentrate and to centralize business interests applies to the dry-goods trade in a very marked degree. The business is being more and more merged into large establishments. The present number of dry-goods houses in New York, for example, falls far below that of 25 or even 50 years ago; but the aggregate amount of merchandise sold there exceeds by far that in any previous period in the history of the city, and this notwithstanding the numerous large and important outlets which have since been added to the list.

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## DRY PILE—DRYDEN

**Dry Pile**, a very important form of galvanic battery, so named from the fact of its requiring merely a slight moisture among its leaves. Various kinds of dry piles are constructed. A very excellent one, Zamboni's dry pile, is made in the following way: Some sheets of paper, covered on one side with tin-foil or silver, such as are used for ornamental purposes, are moistened with sugar and water, and then rubbed over with very finely powdered black oxide of manganese. These are laid one on the top of the other, the silvered side of one being in contact with the oxide of manganese of the next. They are then cut with a punch into disks of about an inch in diameter, and they are put into a glass tube, care being taken that the order just mentioned is preserved. The tube is fitted at each end with a brass cap furnished with a knob, and it is filled so full that the paper disks are pressed firmly together. From 1,000 to 2,000 disks may be used. The knob at the oxide-of-manganese end will be found positively electrified, the other negatively. A pile containing 2,000 disks will charge a Leyden-jar. The glass tube is generally coated with shellac varnish to improve its insulating power. The sugar with which the paper is saturated is intended for a hygro-metric substance. If the pile be carefully kept it will preserve its power for many years. If it be artificially dried it loses it, but will frequently regain it when a sufficient amount of moisture has been absorbed from the air. Its action is quite similar to that of a galvanic battery. See BATTERY; ELECTRICITY; STORAGE BATTERY.

**Dry Point**, a sharp-pointed needle or instrument used by engravers to incise fine lines in copper without the plate being covered with etching-ground or the lines bit in by acid. This tool is much employed in working the more delicate portions of etchings, or in making whole pictures on copper called "dry-point" etchings. See ENGRAVING.

**Dry Rot**, a popular name for the decay of seasoned timber and for certain forms of decay of the trees while still standing. The latter kind is caused mainly by species of shelf-fungi and toadstools, which also attack the stumps of various trees. Economically, the former kind is the more important since it attacks timber after it has been put in place in buildings. In such cases the floors or walls may collapse with more or less damage to property, if nothing worse. The most common fungi producing this kind of dry rot are species of the genera *Polyporus* and *Merulius*, which produce similar effects. The spores germinate in the presence of moisture and the branching threads (*mycelium*) penetrate as far as the wood is moist, destroying the fibre of the wood. The fungus is at first white but later turns brownish-red, producing what is called "red-striped" timber. Drying only temporarily checks growth, for when moisture again reaches the wood the fungus recommences its work of destruction. The wood exposed to frequent changes of moistening and partial drying is most susceptible. But if properly seasoned and then protected by antiseptic treatment, or good paint, will be exempt unless the fungus has already gained entrance. In floors and walls only dry and non-alkaline sound-deadening substances should be used, since these do not favor the germination and growth of the spores which may be present.

**Dry Tortugas**, tôr-too'gas, Florida, a group of small coral keys or islets, 10 in number, at the western end of the Florida Keys, in the Gulf of Mexico, about 70 miles from Key West, lat. 24° 36' N.; lon. 82° 54' W. The principal keys are: East Key, Bird Key, and Loggerhead; and are a part of Monroe County. During the Civil War the Federal Government confined prisoners at Fort Jefferson, on one of the islands, and this practice has been continued. It also serves as a quarantine station.

**Dryad**, in Greek mythology, a nymph of the woods; a deity supposed to preside over the woods; a wood-nymph. Dryads differ from hamadryads in that the latter were attached to particular trees, with which they were born and died.

**Dryas**, (1) a famous Spartan, slain by Diana in the Theban war; (2) a genus of rosaceous plants found in Alpine and Arctic regions; they are small, prostrate shrubs with large white or yellow flowers; (3) a genus of butterflies, of which one species is *D. paphia*.

**Dryburgh**, the ruin of a Premonstratensian abbey in Berwickshire, five miles from Melrose, on the Tweed. It contains the tombs of Sir Walter Scott and his son-in-law, Lockhart.

**Dryden, John**, English poet: b. Aldwinkle All-Saints, Northamptonshire, 9 Aug. 1631; d. London 1 May 1700. He was educated at Westminster, and Trinity College, Cambridge. Left to find his way to distinction by his own exertions, he joined the Royalist party, and hastened to congratulate the king by publishing, in 1661, the verses entitled 'A Panegyric to His Sacred Majesty.' The theatres, which had been closed by the Puritans, now newly opened, after so long a silence, were resorted to with all the ardor inspired by novelty, and seemed to offer the most promising reward. He accordingly prepared for representation the 'Wild Gallant,' acted in 1662-3, but without success. Not cast down by his failure he brought forward the 'Rival Ladies,' which was well received. His next production was the 'Indian Emperor,' which at once raised Dryden to a high pitch of public estimation. The great fire of London put a stop for some time to theatrical exhibitions. In the interval Dryden published the 'Annus Mirabilis,' an historical account of the events of the year 1666, one of the most elaborate of his productions. In 1668 he also published his celebrated 'Essay on Dramatic Poesy,' the first attempt to regulate dramatic writing. The fame of Dryden was now at its height, and so confident was he of the readiness and ease with which he composed, that he entered into a contract with the king's company of players, by which he became bound to produce for them no less than three plays in the course of the year. This was, however, tasking his muse too highly, as he could only produce about half the number contracted for. In 1668 the 'Maiden Queen,' a tragi-comedy, was represented, with what success we are not told. This was followed in 1670 by the 'Tempest,' an alteration from Shakespeare, in which he was assisted by Sir William Davenant. It was received with general applause, notwithstanding the very questionable taste and propriety of the added characters. Dryden was shortly afterward appointed to the offices of royal historiographer and poet-laureate, with a salary of £200 a year.



## DRYDEN — DSCHAKOWA

From this period till 1681 Dryden's life was passed in dramatic composition, and in repressing the insolences occasioned by the jealousy of the small wits of the day. In this time he produced about a dozen of plays, mostly with marked success. Stimulated to exertion by the state of parties, he produced, in 1681, 'Absalom and Achitophel,' which for powerful yet delicate satire is perhaps unsurpassed by any poem in the language. In the next year he published 'The Medal'; 'Mac Flecknoe,' and 'Religio Laici.'

Shortly after the accession of James II. Dryden became a Roman Catholic. At court the new convert was received with open arms; a considerable addition was made to his pension, and his pen was put in requisition to defend the cause which he had adopted. 'The Hind and the Panther' (1687), a polemical poem, in which the controversy between the Roman Catholics and Protestants is allegorically described, went rapidly through several editions, which is rather to be attributed to the fame of the author, and to the adventitious circumstances in which it was published, than to any disposition to acquiesce in its arguments.

At the revolution Dryden was deprived of the offices of poet-laureate and historiographer, and he again turned his attention to dramatic composition. His tragedy of 'Don Sebastian' is of this period. It was at first coolly received, though brought out with great splendor, and it was not till several retrenchments and alterations were made that it rose to that high place in public estimation which it so long maintained. His last play, 'Love Triumphant,' was acted in 1694. During the year previous he had published, with Congreve, Creech, and others, a translation of Juvenal, and one of Persius entirely by himself. About a third part of Juvenal was translated by Dryden, who wrote an essay on satire which was prefixed to the whole. His translation of Virgil appeared in 1697, and so eagerly was it sought after that a new edition was called for in the course of the first six months. Dryden had hardly finished 'Virgil' when he distinguished himself by his immortal 'Ode to St. Cecilia,' commonly known by the name of 'Alexander's Feast.' In 1699 he published his 'Fables,' imitations of Boccaccio and Chaucer. He was buried in Westminster Abbey, between the graves of Chaucer and Cowley.

As a poet Dryden stands very high. What was said of Rome, adorned by Augustus, has been applied by Johnson to English poetry, improved by Dryden—he found it of brick, and left it of marble. In his hands it lost the harshness which distinguishes the writings of Donne and of Cowley, and became eminently harmonious and powerful, but often somewhat turgid. His power of satire is unrivaled. While the lesser poets of the day were encumbering it with foul invective, he struck out a new path in the art. His strong and trenchant blade cut deep, while the coarse weapons of his rivals would not penetrate the surface. Of his powers as a tragic poet his 'Don Sebastian' affords the best example. His comedies are unfortunately stained by the license of the age. See Saintsbury, 'Dryden' (1881); Garnett, 'Age of Dryden' (1896).

**Dryden**, N. Y., village, in Tompkins County; on the Lehigh V. R.R.; noted principally as a health resort on account of its min-

eral springs. The village of Freeville, noted for the George Junior Republic (q.v.), is nearby. Pop. 700.

**Drying Machine**, originally a machine for drying printed calicoes. The apparatus is in a hot room, and has a series of heated steam chests and cylinders with upper and lower rollers, over which the cloth is exposed to the drying air of the apartment. Similar drying cylinders are now used in paper-making machines, both the cylinder machines and those of the Fourdrinier pattern, in which the sheet of pulp is felted on an agitated horizontal web. Drying machines are also used in bleaching, drying, and laundry works; the cylinders, in which the articles to be dried are placed, being made to revolve with great speed, the moisture is thus driven away by the action of centrifugal force. A recent method of drying wool and other textile material is by the Blackman air-propeller. The wool is spread over a perforated surface which is in connection with a revolving propeller, with peculiarly shaped blades, placed at the top of a vertical trunk or shaft. This apparatus dries the wool by drawing heated air through it and expelling the air at the top through a turret in the roof of the building in which it is placed. Yarns are frequently dried by passing through a hot chamber, by means of continuous chains, upon which rollers carrying the hanks are placed.

**Dryobalanops**, dri-ō-bāl'a-nops, a small genus of trees found in the Malay Archipelago. The principal species is remarkable as the source of the Borneo or Sumatra camphor, which is found filling cracks and crevices in the wood. See CAMPHOR.

**Dry'ophis**, a genus of non-venomous, colubrine tree-snakes of India and Malay countries, called whip-snakes owing to the extreme slenderness of their long and flexuous bodies. They move very awkwardly on a smooth surface, but when twining and climbing among branches of trees, whose foliage they simulate in color, they are swift and graceful in the extreme. While retaining their hold by means of a few coils of the tail, their length enables them to dart forth the head to a great distance and seize some lizard or bird unaware of their proximity.

**Drysdale**, William, American journalist and author: b. Lancaster, Pa., 11 July 1852; d. Cranford, N. J., 20 Sept. 1901. In 1876 he was editor of the Philadelphia *Times*; and for over 20 years was on the staff of the New York *Times*, acting as its foreign correspondent (1877-99). He was a popular writer of juvenile stories, and his books have had a wide circulation. They include: 'Proverbs from Plymouth Pulpit' (1887), selections from the writings and addresses of Henry Ward Beecher; 'The Princess of Montserrat' (1890); 'The Mystery of Abel Forefinger' (1893); 'The Young Reporter' (1895); 'The Fast Mail' (1896); 'The Beach Patrol' (1897); 'Helps for Ambitious Boys' (1899); 'Helps for Ambitious Girls' (1900); 'The Treasury Club' (1900); 'Pine Ridge Plantation' (1901); 'The Young Consul' (1901).

**Dschakowa**, dyā-kō'vā, or **Dyakova**, Turkey, city, in the northeast of Albania, on the Grenik, 63 miles east-northeast of Scutari. It contains six mosques, a Roman Catholic and a Greek church. Pop. about 25,000.

**Dual**, in grammar, that number or inflection which is used in some languages when two things are spoken of, whilst another number (the plural) exists to express many. The dual in some languages is a firmly-established grammatical form, as in the classical Greek; in other languages it is used only in certain cases with certain words, or only faint traces of it are to be recognized. The Sanskrit has a dual number. Of modern languages which have a literature, Arabic is the only idiom which has retained it. The Anglo-Saxon had a dual in the declension of the first and second personal pronouns; for example, *wit*, we two; *git*, you two; *uncer*, of s two; *incer*, of you two.

**Dual Personality**, (1) the supposed distinction, and potentially independent action, of each of the cerebral hemispheres; from one of which, the left, arise all the good and ennobling aims of life, while from the other come all the malevolent influences. (2) The heretical doctrine attributed to Nestorius of the two-fold personality of Christ.

**Du'alín**, an explosive compound containing 30 parts of fine sawdust, 20 of saltpetre, and 50 of nitroglycerin. Also called dualin-dynamite. See EXPLOSIVES; NITROGLYCERIN; etc.

**Du'alism, Dualist**. Dualism is the opposite of monism, the philosophical exposition of the nature of things by the adoption of two dissimilar primitive principles, not derived from each other: such, for instance, are the ideal and the real, or matter and spirit. Sir William Hamilton divides dualists into natural dualists (or natural realists), who believe that we have an immediate knowledge both of mind and matter; and hypothetical dualists (or cosmothetic idealists), who believe that we have an immediate knowledge of nothing but mind, but who nevertheless, by various reasonings and arguments, attempt to prove the real existence of an external world. In a stricter sense dualism is confined to a) the adoption of two fundamental beings, a good and an evil one, as is done in some Oriental religions; (b) to the adoption of two different principles in man, namely, a spiritual and a corporeal principle: this is called the psychological dualism.

**Duane, James**, American jurist: b. New York 6 Feb. 1733; d. Duaneburg, N. Y., 1 Feb. 1797. He established a settlement at Duaneburg in 1765; took up the practice of law, and became prominent in his profession. Having bought a considerable amount of land in the territory known as the New Hampshire Grants, now included in the State of Vermont, he was one of the principal advocates of New York's right to that territory; and when New York officials were driven out by Ethan Allen and his followers, Duane was the leader of those who induced the legislature to declare the Vermonsters traitors and outlaws. He was elected to the first Continental Congress, and was a member of the Congress throughout its existence. He was a supporter of the conservative party, believing in the English form of government and opposed to republicanism, and he stood against the signing of the Declaration of Independence, striving to delay, and if possible prevent, separation from England. He returned to New York after its evacuation by the British, and was the first mayor under the new

charter (1784-89); was a member of the committee to draft the State Constitution of New York; sat in the State Senate 1782-85, and 1789-90; and was United States district judge 1789-94.

**Duane, James Chatham**, American military engineer: b. Schenectady 30 June 1824; d. New York 8 Nov. 1897. He was graduated from West Point in 1848, and was instructor there for a time. He was engineer in charge with the Utah expedition 1858, and served in the Civil War with the Army of the Potomac and the Army of the South. In 1865-68 he had charge of the construction of defenses at the eastern entrance to New York harbor; was lighthouse engineer for the northeast Atlantic coast, and superintendent of fortifications in Maine and New Hampshire; in 1886 he became chief of engineers with the rank of brigadier-general, and retired in 1888. From 1888 to 1897 he was one of the Croton aqueduct commissioners.

**Duane, William**, American politician: b. near Lake Champlain, N. Y., 1760; d. Philadelphia, Pa., 24 Nov. 1835. He learned printing, and in 1784 went to seek his fortune in India. He rapidly amassed property, and became editor of an Indian journal, entitled the 'World.' Having taken sides against the local government in a dispute with some of its troops, he was seized and sent to England, and his large fortune was confiscated. In 1795 he returned to America, and became editor of the 'Aurora,' published at Philadelphia, which was made by his able management the most influential organ of the Democratic party; so much so, that Jefferson attributed to its vigorous support his own election to the Presidency. The change of the seat of government from Philadelphia to Washington caused the 'Aurora' to decline in political importance. Duane retired from its editorship in 1822, and then traveled through the republics of South America. On his return he published 'A Visit to Colombia' (1826). His other works include 'Military Dictionary' (1810); and 'Handbook for Riflemen' (1813), which were for some time standard authorities.

**Duane, William John**, American politician: b. Clonmel, Ireland, 9 May 1780; d. Philadelphia 26 Sept. 1865. He was a son of William Duane (q.v.). Appointed secretary of the treasury by President Jackson in 1833 he was removed from office the same year because of his refusal to allow the government deposits in the United States Bank to be removed without the authorization of Congress.

**Duban, Jacques Félix**, zhāh fā-lēks dü-bān, French architect: b. Paris 14 Oct. 1798; d. Bordeaux 20 Dec. 1870. He studied under Debret, and his first work of importance was the completion of the Palais des Beaux Arts, in the execution of which he is charged with having sacrificed harmony of proportion and strength to a fondness for ornamentation. In 1845 he was employed in the restoration of the ancient chateau of Blois, and in 1848 was appointed architect of the Louvre. The façade on the river side, and the Apollo gallery, were restored from his plans.

**Du Barry, Jeanne Bécu**, zhāh bā-kü dü bā-rē, COMTESSE, mistress of Louis XV: b. Vaucouleurs 19 Aug. 1746; d. Paris 6 Dec. 1793.

She was presented to the King in 1769, who had her married for form's sake to the Count du Barry. She exercised a powerful influence at court, and with some of her confidants completely ruled the King. Important offices and privileges were in her gift, and the courtiers abased themselves before her. After the death of Louis she was dismissed from court and sent to live in a convent near Meaux. She received a pension from Louis XVI. During the Reign of Terror she was arrested as a royalist and executed.

**Du Bartas, dü'bār'tā', Guillaume Salluste,** French poet: b. Montfort, in the department of Gers, 1544; d. Ivry 14 March 1590. He undertook various diplomatic missions to foreign courts for the Huguenot cause; fought in the Huguenot army and was killed in the battle of Ivry. His fame rests upon two epic poems, the second unfinished, entitled 'La Sepmaine' (The Week) and 'La Seconde Sepmaine.' The first, which is far the better of the two, describes the creation of the world; the second the period from the creation to the incarnation of Christ. These poems were very popular in France, and in 1598 Joshua Sylvester translated them into English.

**Du Bellay, Jean, zhōn dü bēl-lā,** French cardinal and statesman: b. 1492; d. Rome 16 Feb. 1560. He enjoyed the favor of Francis I., and was sent as ambassador to Henry VIII. of England and the Pope, Paul III. He became Bishop of Bayonne in 1526, Bishop of Paris in 1533 and Cardinal in 1535. He was appointed lieutenant-general of the kingdom during the absence of Francis, who was engaged against the Emperor Charles V. in Provence. Falling into disgrace on the death of this king, he retired to Rome. Du Bellay protected and encouraged letters, and it was at his suggestion that the College of France was founded. Rabelais was attached to his establishment.

**Dubbs, Joseph Henry:** b. North Whitehall, Pa., 5 Oct. 1838. He was graduated at Franklin and Marshall College 1856, and at the Mercersburg Theological Seminary 1859. After several pastorates in the Reformed Church he became in 1875 professor of history and archaeology in Franklin and Marshall College. He is a member of various ethnographic and historical societies in the United States, Great Britain, and France, and has published: 'Historic Manual of the Reformed Church' (1885); 'Home Ballads and Metrical Versions' (1888); 'Why am I Reformed?' (1889); and a large number of historical monographs, addresses, etc.

**Dublin, Ireland,** on the river Liffey, within a mile of Dublin Bay. The Liffey divides the city into two equal parts. From the point where the Liffey enters the bay it is embanked on either side with a wall of freestone, forming a range of spacious quays through the whole city. The river is crossed by nine handsome bridges, six of stone, two of iron, and one swivel-bridge. Dublin is also nearly insulated by two canals, very important for inland communication. The houses, with the exception of the principal public structures, are generally brick, and from three to five stories high. The principal thoroughfares are toward the south side of the city. Grafton Street is the busiest commercial locality in Dublin, and Westmoreland Street, connecting the south side by O'Connell Bridge with Sackville

Street, which contains monuments to O'Connell and Nelson. The O'Connell Bridge, formerly called Carlisle Bridge, was rebuilt and opened for traffic in 1880. A line of railway, called the "Loop line," joins the north and south sides of the city, and forms a through connection between the four railroad systems of Ireland.

In the centre of the south side stands Dublin Castle, on a slight elevation, originally built early in the 13th century. It is now the official residence of the Lord-Lieutenant of Ireland, but is more remarkable for size than for architectural features. The castle chapel is an exquisite specimen of Gothic architecture. East from the castle, and facing College Green, is the Bank of Ireland, formerly the Irish Parliament House, a large and elegant structure, with a noble colonnade of Ionic pillars. At right angles to the bank, and facing the same area, is Trinity College, an imposing modern structure of the Corinthian order. The pile of buildings known as the Four Courts, stretching along King's Inns Quay has a portico of six Corinthian columns. It accommodates the courts of chancery, queen's bench, common pleas, and exchequer, which are now united under the title of The High Court of Justice. The most important of the other public buildings are the custom-house, with a cupola 125 feet high; the King's Inns, the post-office, rotunda, corn exchange, the mansion-house, corporation buildings, sessions house, the Wellington military barracks, Mountjoy convict prison, North and South Union workhouses, south city markets, Christian Union buildings, Royal College of Surgeons, the Science and Art Museum, the Leinster Hall, and the four railway stations.

The most important literary and scientific institutions are Trinity College; the Royal University of Ireland; the Roman Catholic University College; Wesley College; the Royal Dublin Society; the Royal Hibernian Academy of Painting, Sculpture, and Architecture; the Royal Irish Academy; the Archaeological Society; and the Royal Zoological Society. The principal libraries, besides that of Trinity College, are the National Library; Marsh's Library, containing about 18,000 volumes; and that of the Royal Dublin Society. At Marlborough House are the extensive buildings in which the National Board of Education has its chief offices. They consist of two training colleges for teachers, with practising schools, professors' offices and book-stores. In the centre of College Green is an equestrian statue of William III., erected in 1701, and in front of Trinity College are bronze statues of Burke and Goldsmith. There are also statues of O'Connell, Moore, Grattan, Smith O'Brien, Sir John Gray, and others. In the Phoenix Park is an obelisk, 210 feet high, in honor of the Duke of Wellington. Glasnevin Cemetery, to the north of Phoenix Park, contains memorials to O'Connell, the "Manchester Martyrs," Curran, Hogan, and others.

Dublin contains two Protestant Episcopal cathedrals—St. Patrick's and Christ Church. St. Patrick's Cathedral is an antique building, erected in 1190. Between 1860 and 1865 it was restored at a cost of £150,000 by Sir B. L. Guinness, M.P. Christ Church, built in 1038, the ancient cathedral of Dublin, is another venerable pile. In 1878 it was reopened after being restored at a cost exceeding £200,000. St. George's Church is of pleasing architecture; and

## DUBLIN

a fine Presbyterian Church is in Rutland Square. The Roman Catholic Cathedral in Marlborough Street is a large edifice. The charitable institutions are numerous, and some of them possess splendid buildings. They include among them the Royal Hospital for disabled soldiers, designed by Sir Christopher Wren; several infirmaries; the lying-in hospital; two lunatic asylums, one of which, St. Patrick's, or Swift's Hospital, was founded by Dean Swift. The Royal Barracks, affording accommodation for 5,500 men, are in the west end of the town, near the river. There are several other military barracks.

A little northwest of the city, up the Liffey, is the Phoenix Park, one of the most extensive and beautiful public parks of which any European city can boast. Its area is 1,759 acres. In the Phoenix Park are the Vice-regal Lodge, the residence of the lord-lieutenant; the chief secretary's and under-secretary's official residences; the Royal Hibernian Military School and the depot of the Royal Irish Constabulary; also the gardens of the Royal Zoological Society. In 1880 St. Stephen's Green, on the south side of the city, became a public park through the munificence of Lord Ardilaun; and in 1887 Killiney Hill also was opened as a public park by Prince Albert Victor.

The manufactures carried on in Dublin are of little note. The poplins, a fabric of silken warp and woolen weft, for which Dublin has long been celebrated, are still in some demand, and there is considerable brewing and distilling. The trade by water is important, the tonnage of the shipping entered and cleared amounts to considerable each year. Dublin returns four members of Parliament. Pop. (1901) 289,108.

**Dublin, University of.** The first university of Dublin was founded in 1320 in connection with Saint Patrick's Cathedral. Having no endowment, and owing to changes in government and religion throughout the country, the university gradually declined, until it ceased to exist in the reign of Elizabeth. The present university was founded in 1591, when a charter, or letters-patent, was granted by Queen Elizabeth for the incorporation of the "College of the Holy and Undivided Trinity." This college is stated in the charter to be incorporated as the "mother of an university," whence it appears that it was intended to be only the first of a number of colleges to be afterward established in connection with the same university, the senate of which is incorporated by a charter distinct from that of Trinity College. Up to this time, however, no other such colleges have been established, so that Trinity College alone still enjoys the rights of the university. Although Elizabeth promised much, but little was done by the Crown for the support of the institution. The suppressed monastery of All Hallows was given to the new university and a fund was raised among the Irish nobles. Under James I. more aid in money and lands was given to the school. In 1637 changes were made in the constitution of the university.

The members of the corporation consist of a provost, 7 senior fellows, 26 junior fellows, and seventy foundation scholars. The management of the college is entrusted to the provost and senior fellows in conjunction with the visitors and the council, the last named body consisting of the provost, four senior fellows,

four junior fellows, four professors who are not fellows, and four other members of the senate. The senate of the university, as incorporated by royal charter, consists of "the chancellor of the university, or, in his absence, of the vice-chancellor, and such doctors or masters of the university as shall have and keep their names on the books of Trinity College." The senate possesses, under prescribed conditions, the right of electing the chancellor of the university. It is also the body which grants degrees; subject to the sanction of the college board and of the caput of the senate. This latter body consists of the chancellor or vice-chancellor, provost (or vice-provost), and the senior master non-regent, and every member of the caput has the right of refusing a degree by a veto. The fellows are appointed for life. The senior fellows are promoted from the number of the junior fellows in order of seniority, and every vacancy among the junior fellows is filled up by the provost and senior fellows after a strict examination for 12 days in mathematics, pure and applied, experimental sciences, classics, with Hebrew and cognate languages, and mental and moral science. The scholars are chosen from among the undergraduates, after an examination in pure and applied mathematics and logics or experimental science, or in Greek, Latin, and English composition. Non-foundation scholars are not members of the corporation of the college. Scholars receive an annual salary of £20, have their commons free of expense, and their rooms for half the charge paid by other students. They hold their scholarships until the end of the June quarter of the fifth year following their election, or following the time at which they become or might have become masters of arts, whichever period terminates first. Students, before being admitted, must submit to an examination in Greek, Latin, arithmetic, English composition, history, and geography. Students may enter as belonging to one of four classes. The first consists of noblemen, noblemen's sons, and baronets. The second consists of the fellow-commoners (who dine at the fellows' table). The third and most important is the class of pensioners, forming the great body of the students; and the fourth is the sizar, who are partially maintained out of the college funds and are now admitted by competitive examination. These last are limited to 30 in number. The academical year is divided into three terms—Hilary, Trinity, and Michaelmas term. To obtain the B.A. degree the student must keep eight terms in all, covering normally four academic years. Terms are kept during the undergraduate course, either by lectures or by examinations, but terms in divinity, law, medicine, and engineering must be kept by attendance on the lectures of the professors. The system of instruction is superintended by the fellows, together with a large staff of professors. Several of the junior fellows act as tutors, and every student must place himself under one of these on entering the college. The tutors during term deliver lectures on the subjects necessary to a degree. These are: In the first year, mathematics, Greek, Latin, English composition; in the second year, mathematics, mathematical physics, logic, Greek, Latin, English composition; in the third year, logic, mathematical physics, English composition, Greek, Latin, experimental and natural science, astronomy, history, French, German; and in the

fourth, astronomy, ethics, English composition, logic, mathematical physics, languages, experimental and natural science, history, and political science. During the first academic year a student is called a junior freshman; during the second, a senior freshman; during the third, a junior sophister; and during the fourth, a senior sophister. Students who have successfully passed all the necessary examinations in the course given above, have the degree of B.A. conferred on them by grace of the senate in full congregation. Those who wish to obtain honors must pass through a more extended course of study. Honors are attainable in seven departments: 1, mathematics and mathematical physics; 2, classes; 3, logic and ethics; 4, experimental science; 5, natural science; 6, history and political science; 7, modern literature. Those who successfully pass the examinations in any of these departments are classed according to merit as senior or junior moderators, and respondents. Noblemen and noblemen's sons are entitled to have the degree of B.A. conferred on them *per specialem gratiam*; and fellow-commoners are entitled to receive it with one term-examination less than pensioners. The degrees are conferred on commencement days, of which there are four in each year. There are divinity, law, medical, and engineering schools in connection with the university, and degrees or licenses in each of these branches are granted by the university senate on the completion of the prescribed courses. The degrees of D.Sc. and Litt.D. are conferred on B.A.'s who have shown certain scientific or literary claims. The degrees of bachelor and doctor in music are also conferred.

The college possesses a fine library of about 250,000 printed volumes and 1700 manuscripts; and the number is increased annually by about 1,500 volumes, which are partly purchased and partly obtained under the copyright act. It has also a well-stocked botanic garden and museum. The observatory, five miles distant, at Dunsink, is the official residence in Ireland of the royal astronomer. In 1613 James I. granted to the university the right of returning two members to Parliament. One was taken away at the Union, but was restored by the reform bill of 1832. The parliamentary constituency consists of the provost, fellows and foundation scholars, ex-fellows and ex-foundation scholars, masters of arts, surgery, and engineering, and graduates holding all higher degrees.

**Duboc, dü-bök', Julius**, German author: b. Hamburg 10 Oct. 1829; d. June 1903. He studied at Giessen, Leipsic and Berlin; and wrote much for the leading liberal periodicals, especially the 'National Zeitung.' He published 'Geschichte der Englischen Presse' (1873); 'Die Psychologie der Liebe' (1874); 'Das Leben ohne Gott' (1875); 'Gegen den Strom' (1877); a collection of his earlier essays: 'Der Optimismus als Weltanschauung' (1881); 'Jenseits von Wirklichen' (1896); and 'Fünfzig Jahre Frauenfrage in Deutschland,' a collection of essays on the woman question.

**Dubois, dü'bois', Augustus Jay**, American engineer: b. Newton Falls, Ohio, 25 April 1849. He was graduated at Sheffield Scientific School in 1869; in 1874 was appointed professor of civil engineering at Lehigh university, and in 1876 professor of mechanical engineering at Sheffield Scientific School. After 1884 he was professor

of civil engineering at the last institution. He has published 'Elements of Graphical Statics' (1876); 'The New Method of Graphical Statics' (1876); 'Strains in Framed Structures' (1883; 11th edition, 1900); 'Elements of Mechanics' (1893-5).

**Dubois, Clément François Théodore**, klāmôn frän-swä tä-ô-dôr dü-bwä, French musical composer: b. Rosnay (Marne) 1847. He studied at the Paris Conservatory, and won the Prix de Rome in 1861. He was organist at the Church of the Madeleine, professor of harmony, then professor of composition at the Conservatory, and finally became director of that institution. In 1894 he became a member of the Academy of Fine Arts. His compositions include the cantata, 'Atala'; the operas, 'Aben Hamet'; 'Xaviere'; and 'Circe'; the oratorios, 'The Seven Words of Christ', and 'Paradise Lost'; 'The Baptism of Clovis'; and a number of organ pieces, masses, etc.

**Du Bois, dü-bois', Constance Goddard**, American author: b. Zanesville, Ohio. She has been an active supporter of efforts to improve the condition of the Mission Indians of Southern California. She has published 'Martha Corey: a Tale of the Salem Witchcraft' (1890); 'Columbus and Beatriz' (1892); 'A Modern Pagan' (1895); 'The Shield of the Fleur-de-Lys' (1895); 'A Soul in Bronze' (1900).

**Dubois, Edmond Paulin**, ăd-môn pō-lăn dü-bwä, French hydrographer: b. Brest 12 July 1822; d. there 11 Nov. 1891. He made voyages in the Indian Ocean and along the west coast of Africa; and in 1851 was made professor at the Ecole Navale in Brest. He invented a compass with a double needle to determine the variation due to the ship's ironwork, and wrote 'Cours d'Astronomie' (1858); 'Etude historique et philosophique sur le Mouvement du Globe' (1861); 'Les Passages de Vénus sur le Disque Solaire' (1883); 'Cercle nautique' (1888); and edited the 'Ephémérides Astronomiques.'

**Dubois, Guillaume**, gē-yōm, French cardinal and statesman: b. Brives-le-Gaillard, Corrèze, France, 6 Sept. 1656; d. Versailles 10 Aug. 1723. He became tutor to the Duke of Chartres, afterward Duke of Orleans, and when in 1715 the Duke was declared regent, Dubois was appointed by the Duke counselor of state. He succeeded in overcoming the dislike of George I. of England to the person of the regent, and in 1717 concluded the triple alliance between England, France, and Holland. He was rewarded by the ministry of foreign affairs, and began to aspire to the highest dignities of the church. The archbishopric of Cambrai having become vacant, Dubois ventured to request it of the regent, although he was not even a priest. As the king of England united with Dubois in his request, he obtained it, and in one morning received all the orders, and a few days after, the archbishopric. By his consummate address he obtained a cardinal's hat, and in 1721 was appointed prime minister.

**Dubois, Jean Antoine**, zhôn ân-twăn, French abbé and missionary: b. Saint-Remèze, department of Ardèche, 1765; d. Paris 7 Feb. 1848. He spent 32 years in the East Indies, and on his return published 'Letters on the State of Christianity in India' (1823); which produced



much controversy in England from the fact of his having frankly expressed therein his disbelief in the possibility of the conversion of the Hindus. He wrote several works relating to the religion and the traditions of India, and many contributions to the 'Bulletin des sciences,' and to the journals of the Asiatic societies of London and Paris. His most celebrated work, 'Description of the Character, Manners, and Customs of the People of India, and of their Institutions, Religious and Civil,' was purchased for £800 by the East India Company, published at its expense in London in 1810, and afterward published in French under the title of 'Mœurs, institutions, et cérémonies des peuples de l'Inde' (1825).

**Dubois, John**, American Roman Catholic bishop: b. Paris 24 Aug. 1764; d. 20 Dec. 1842. As student in the College Louis le Grand he had as fellow students Camille Desmoulins and Robespierre. In 1781 he was ordained priest. With thousands of others of other ecclesiastics he was forced to flee from France in the Revolution and came to the United States in 1791. His first charge in this country was at Norfolk, Va., whence he was transferred to Richmond; there he was for a time a guest in the house of James Monroe and was the friend of prominent citizens, Patrick Henry undertaking his instruction in the English language. From Richmond he was transferred to Frederick, Md., the only priest then stationed between Baltimore and St. Louis. In 1809 he founded Mount St. Mary's College near Emmitsburg, Md., and was its first president, occupying at the same time two or three professorships. In addition he assumed the duties of chaplain and director of the house of the Sisters of Charity then founded by Mrs. Seaton in the neighborhood of Emmitsburg. He was subsequently appointed Bishop of New York, the diocese including that State and New Jersey, with a Catholic population of 150,000 souls, 8 church buildings and 18 priests. Owing to old age and increasing infirmities in 1838 he obtained a coadjutor in the person of John Hughes, who became his successor.

**Dubois, Louis**, loo-ē, Belgian painter: b. Brussels 1830; d. there 28 April 1880. He was one of the most prominent painters of the realistic school, and worked equally well as a painter of portraits, marines, still life, and landscapes. Among his works deserving mention are: 'The Rice Eater'; 'The Meuse'; 'Priests Preparing for Mass'; and 'The Billiard Player.'

**Dubois, Paul**, pōl, French sculptor: b. Nogent-sur-Seine 18 July 1829. In 1837 he entered the College Louis le Grand, and later took up the study of law, which he followed until his 27th year, when he became a pupil of Tousseint (q.v.). In 1863 he exhibited 'Narcissus at the Bath,' now in the Luxembourg, and in 1864, a bronze of John the Baptist as a young man. 'The Florentine Minstrel,' also in the Luxembourg, is his most popular work. Among his productions is a successful statue of 'Joan of Arc,' in Rheims. The most elaborate of his sculptures is a tomb in Nantes Cathedral, decorated with many statues and bas-reliefs. He is also a painter. He was made an officer of the Legion of Honor in 1867, and became grand officer in 1889. He is a director of the Luxem-

bourg, and also of the National School of Fine Arts.

**Du Bois, du-bois', William Edward Burghardt**, American educator: b. Great Barrington, Mass., 23 Feb. 1868, of negro descent. He was graduated at Fisk University 1888, and at Harvard 1890, subsequently studying at the University of Berlin. He has been a Fellow of Harvard, assistant in sociology at the University of Pennsylvania, and since 1896, professor of economics and history in Atlanta University. He has published: 'The Suppression of the African Slave Trade to the United States, 1638-1870' (1896); 'The Philadelphia Negro' (1899); 'Relation of the Negro to the Whites in the South' (1901); 'Souls of Black Folk' (1903); 'The Negro Artisan: Report of a Social Study' (1903), in the Atlanta University publications, of which he is general editor.

**Du Bois-Reymond, Emil**, ā-mēl dü bwā-rā-mōh, German physiologist: b. Berlin 7 Nov. 1818; d. there 26 Dec. 1896. He studied theology, geology, and latterly anatomy and physiology at Berlin under Johann Müller, whom he succeeded as professor of physiology in the University of Berlin in 1858. In 1867 he became permanent secretary of the Berlin Academy of Sciences. His principal publication is 'Researches in Animal Electricity' (1848-84); but he published several other technical works, and also some lectures of which the chief is entitled 'Ueber die Grenzen des Naturerkennens'.

**Dubois, du-bois', Pa.**, a borough, county-seat of Clearfield County; on the Buffalo, R. & P., and the Allegheny V. R.R.'s; about 80 miles northeast of Pittsburg. It is in a coal mining region, and besides its mining interests, it has iron works, flour and lumber mills, and tanneries; a large amount of mining and agricultural implements are manufactured. Pop. 9,500.

**Dubovka**, doo-bōf'kā, Russia, city, in the government of Saratov, on the Volga. It has an extensive river trade in wool, iron, oil, and grain. Pop. (1902) 17,123.

**Dubufe, Claude Marie**, klōd mā-rē dü-būf, French painter: b. Paris 1790; d. 24 April 1864. He was a pupil of David; among his works are: 'Achilles Protecting Iphigenia'; 'Christ Still-ing the Tempest'; 'Release of St. Peter'; 'Surprise'; 'Village Girls of Normandy'; and portraits of Louis Philippe and the Queen of the Belgians.

**Dubufe, Edouard**, ā-doo-ār, French painter: b. Paris 30 March 1820; d. Versailles 10 Aug. 1883. He was a pupil of his father, Claude Marie Dubufe (q.v.), and of Delaroche. Among his works are portraits of the Empress Eugénie, Rosa Bonheur, Gounod, the Younger Dumas, and Emile Augier; also a number of religious paintings, including 'The Prodigal Son.'

**Dubufe, Edouard Marie Guillaume**, ā-doo-ār mā-rē gē yōm, French painter: b. Paris 16 March 1853. He is a son of Edouard Dubufe (q.v.). Among his paintings are 'St. Cecilia'; 'Music, Sacred and Profane'; 'Autumn'; 'The Flight into Egypt'; and several portraits. He has also decorated the Hôtel de Ville in Paris and the Salle des Fêtes de l'Elysée.

**Dubuque**, doo-būk', Iowa, city, county-seat of Dubuque County; on the Mississippi



River, the Burlington, the Chicago G. W., the Chicago, M. & St. P., and the Illinois C. R.R.'s, 189 miles northwest of Chicago. It has steamer communication with the leading ports on the Mississippi and is connected with the opposite shore of the river by two bridges. The city is built partly on a terrace 20 feet above the river, and partly on the bluffs, which rise 200 feet high. The lower or business portion is regularly laid out and compactly built, and in the upper portion the streets rise picturesquely one above another. Among the prominent buildings are the United States Government Building, the Central Market, St. Raphael's Cathedral (R.C.), and several other important churches.

*Business Interests.*—The city is the centre of the lead region of Iowa, northwestern Illinois, and southwestern Wisconsin, and contains large zinc works. In 1900 there were 460 manufacturing concerns reported, with a combined capital of \$8,117,358, employing 5,503 persons, paying \$2,012,153 in wages, and yielding products aggregating in value \$10,952,204. The principal manufactures were packed meat, lumber, foundry and machine shop products, malt liquors, bread and bakery products, carriages and wagons, millinery, and clothing. The imports of merchandise at Dubuque in the year ending 30 June 1900 aggregated in value \$40,940. In 1899 there were three national banks, with a combined capital of \$700,000 and a surplus of \$99,000, and several State, savings, and private banks.

*Public Interests.*—The city is the winter harbor for boats on the Upper Mississippi. In 1893 it was created the see for an archdiocese of the Roman Catholic Church. It is lighted with electricity, has an extensive waterworks system, public library, several hospitals and asylums, electric street railways, and an inclined cable road leading from the river level to the bluffs. Two gunboats for the United States navy have been built here.

*Education.*—In 1899 there were 18 public day schools, with 5,458 pupils enrolled, of whom 4,185 were in average daily attendance; 126 teachers; and public school property valued at \$360,000. There were over 3,500 pupils enrolled in the private and parish schools. For higher instruction there were a public high school, the academies of St. Joseph, St. Mary, St. Vincent, and the Visitation, and the State Institute of Arts and Sciences.

*History.*—The city was named in honor of Julien Dubuque, a French trader, who with 10 others settled here in 1788 to mine lead. This was the first settlement in what is now the State of Iowa. The settlement was abandoned after Dubuque's death in 1810, and the site was not again occupied till 1833. This last was the first permanent settlement in Iowa. Pop. (1900) 36,297.

**Duc, Joseph Louis**, zhō-zěf loo-ē dūk, French architect: b. Paris 25 Oct. 1802; d. 22 Jan. 1879. Winning the Prix de Rome in his 23rd year, in 1840 he was chosen to assist in designing the monument in the Place de la Bastille. His chief work is the Palace of Justice in Paris, which occupied the greater part of 25 years in building, for which the Emperor Napoleon III. gave him \$20,000 as a special prize. The architect devoted the greater part of this sum to establish a prize for excellence in architecture.

For a description of the Palace of Justice see PARIS.

**Du Camp**, dü kăn, **Maxime**, French writer: b. Paris 8 Feb. 1822; d. Baden-Baden 8 Feb. 1894. He wrote the history of the Paris Commune: 'The Convulsions of Paris' (1878-9), and other historical sketches: 'Egypt, Nubia, Palestine and Syria' (1852); but his greatest work is 'Paris: Its Organs, its Functions, and its Life' (1869-75). He likewise wrote some lyric poems: 'Modern Chants' (1855); 'Convictions' (1858); and several novels, among them: 'Memoirs of a Suicide' (1853); 'The Six Adventures' (1857); 'The Man with the Gold Bracelet' (1862).

**Du Cange**, dü kănzh, or **Ducange**, **SIEUR Charles du Fresne**, or **Dufresne**, French historian and philologist: b. Amiens 18 Dec. 1620; d. Paris 23 Oct. 1688. His family name was Dufresne, and Sieur Ducange was his title as lord of his paternal estates. He was an alumnus of the college of the Jesuits in his native town and after completing his studies there took up the study of jurisprudence, and in 1631 was admitted to practice as an advocate at the bar of the parliament of Paris. Meeting with discouragement in his profession, he withdrew to his native place and there devoted himself to the historical, linguistic and philological studies which have made him illustrious as a scholar. He was indefatigable in research, and his linguistic attainments, critical acumen and various knowledge enabled him to digest and sort out of the infinite mass of material the facts of history and the points of philology which were necessary for the composition of the many solid memoirs of which he is author. And those works involved titanic labor even if we consider only the work of the pen in making "copy" for the printer; for every word was penned with his own hand. Of the long list of his printed works the two which are most enduringly important—and frequent reference to these is imperative on whosoever studied the history of the Middle Ages at its sources—are his dictionaries of the Greek and Latin languages in the period of their decline. Among other writings may be named 'Histoire de l'empire de Constantinople sous les empereurs français'; 'Historia byzantina duplici commentario illustrata'; 'Chronicon Paschale a mundo condito ad Heraclii imperatoris annum vigesimum.'

**Ducange, Victor Henri Joseph Brahain**, vĕk-tōr ōn-rē zhō-zěf brā-hăn, French poet and romancer: b. The Hague 24 Nov. 1783; d. Paris 15 Oct. 1833. His first stories, 'Agatha,' and 'Valentine,' were received with great favor; but for his too realistic description in 'Valentine' of the excesses of the Royalist bands, he was sent to jail for six months. Released, he was again imprisoned, ostensibly for vilifying the French Academy. Once more he offended with 'Thelene, or Love and War,' and had to take refuge in Belgium. Other novels are: 'The Confessor Doctor'; 'The Artist and the Soldier,' etc. Of his numerous plays the best and most famed is 'Thirty Years, or the Life of a Gambler.' His novels are vividly dramatic and descriptive.

**Ducas**, doo-kās, **Michael**, Byzantine historian of the 15th century. He was a descendant from an imperial family, and himself held a high position at the court of Constantine Palæologus, the last emperor of Constantinople. After the

conquest of that city by Mohammed II. he took refuge with the Prince of Lesbos, Dorino Gate-luzzi, and his prudence and skill succeeded in saving the independence of Lesbos for a time. It is probable that he wrote in his old age the history of the Byzantine empire. This begins with an outline of universal chronology, and does not become detailed and truly instructive till the reign of John Palæologus I., and it terminates abruptly in the middle of a sentence, at the capture of Lesbos in 1462. It is the most difficult of all the Byzantine histories, written in a barbarous style, but is judicious and impartial.

**Ducat**, the name of certain gold or silver coins current in several countries, but is no longer the monetary unit in any country. It had its origin in 1140, and was formerly a favorite coin with the Dutch, and, owing to the excellence of the pieces struck, they were sought for and imitated by several other countries, and especially Russia. Ducats now everywhere circulate at a valuation, where they circulate at all, or are bought and sold simply as bullion. The following are some of the best known:

1. The gold ducat of Holland, weighing 3.494 grammes, .983 fine, value about \$2.33. 2. The gold ducat of Russia, which is of precisely the same weight, fineness, and value as the Dutch ducat. 3. The gold ducat of Austria-Hungary, weighing 3.4904 grammes, .986 fine, value \$2.34. 4. The gold ducat of Sweden, weighing 3.486 grammes, .9766 fine, value \$2.31. 5. The gold ducat of Hamburg, valued at \$1.85. 6. The silver ducat of Sicily, weight 22.943 grammes, .833 fine, value 84 cents. SEE COIN; NUMISMATICS.

**Ducato, Cape.** SEE CAPE DUCATO.

**Ducatoon**, dük-a-toon', or **Ducastone**, formerly a Dutch silver coin worth 3 gulden 3 stivers, or \$1.30. There were coins of the same name in Italy. In Tuscany its value was about \$1.35, in Savoy slightly more, and in Venice about 97 cents.

**Duccio di Boninsegna**, düch'ō dē bōn-ën-sān'yā, Italian painter, founder of the Siennese school: b. Siena about 1260; d. about 1320. His great work is the altar-piece of the cathedral in Siena, which, when completed was carried in a procession to the cathedral. It shows the Madonna surrounded by saints and angels; on the reverse are 26 pictures of the Passion of Christ. Two other Madonnas in Siena are also attributed to him.

**Ducey, Thomas James**, American Roman Catholic clergyman: b. Lismore, Ireland, 4 Feb. 1843. He came to the United States when five years old, and after his graduation at the Theological Seminary in Troy, N. Y., was ordained priest in 1868. He founded St. Leo's Church in New York in 1880 and has been its pastor ever since. In 1891 the Pope conferred on him the title of Monsignore. He has been an active champion of labor and reform.

**Du Chaillu**, dü shā-yü', **Paul Belloni**, American traveler: b. Paris 31 July 1835; d. St. Petersburg, Russia, 30 April 1903. He spent his youth in the French settlement on the Gaboon, on the west coast of Africa, where his father was a merchant, and received his education from the Jesuits there. In 1852 he went to the United States, of which he afterward became a naturalized citizen. In 1855 he began his first journey through western Africa, and spent

till 1859 alone among the different tribes, traveling on foot upward of 8,000 miles. He collected several gorillas, never before hunted, and rarely, if ever, before seen by any European. The result of this journey was his work: 'Explorations and Adventures in Equatorial Africa' (1861). This book contained much important information on the zoology, geography, and ethnology of parts of the continent then unknown to Europeans, and by many authorities Du Chaillu's statements were received with suspicion; but subsequent expeditions by others fully confirmed his substantial accuracy. A second expedition was made by him in 1863, an account of which, under the title 'A Journey to Ashango Land,' appeared in 1867. 'The Land of the Midnight Sun,' an account of a tour in northern Europe (1881), had a considerable success. He has also published a number of books intended for youth, and based on his travels. One of his later works is 'The Viking Age' (1889), a treatise on the ancestors of the English-speaking peoples. In addition to the works named above may be mentioned his 'Stories of the Gorilla Country' (1868); 'Wild Life Under the Equator' (1869); 'Lost in the Jungle' (1869); 'The Country of the Dwarfs' (1872); 'The Land of the Long Night' (1899); 'The World of the Great Forest' (1900); 'How Animals, Birds, Reptiles, and Insects Talk, Think, Work, and Live' (1900).

**Duchâtel**, dü shā-těl, **Charles Marie Tan-neguy**, COUNT, French economist and politician: b. Paris 19 Feb. 1803; d. there 6 Nov. 1867. Prior to 1830 he took an active part in editing the *Globe*, one of the leading organs of the Liberalists. He began his parliamentary career in 1832, was named secretary-general of the finances in 1833, and in 1835 was appointed to the ministry of commerce. He resigned with his colleagues in February 1836, and now became one of the most energetic leaders of the opposition. At the accession of the cabinet of Soult and Guizot in 1840 he came again into power as minister of the interior, and retained this position with but a short interruption till the revolution of 1848, after which he lived in retirement. The measures supported by him both as deputy and minister were generally of a financial character, but he also took a prominent part in the establishment of railways and telegraphs in France.

**Duché**, dü-shā', **Jacob**, American Episcopal clergyman: b. Philadelphia 1739; d. there January 1798. In 1759 he was ordained an assistant minister or Christ Church in Philadelphia, of which in 1775 he became rector. He was a man of brilliant talents and impressive eloquence, and at the meeting of the second congress in 1775, just after the outbreak of the War of the Revolution, made the opening prayer. He was for three months chaplain of Congress, but subsequently adopted the Royalist side. Beside several other works he wrote 'Casipina's Letters.'

**Duchesne**, dü-shān, **André**, French historian: b. Touraine, Isle Bouchard, May 1584; d. 30 May 1640. History and geography were his favorite studies from his youth, and under Richelieu's ministry he was appointed royal geographer and historiographer. His most important works are: 'Histoire d'Angleterre, d'Ecosse et d'Irlande' (1614); 'Histoire des Papes jusqu'à Paul V.' (1616); 'Histoire des rois,

## DUCHESS OF DEVONSHIRE — DUCK

'ducs, et comtes de Bourgogne' (1619-28), and his collections of the early Norman and French histories. His industry was extraordinary; he is said to have left more than 100 folios in manuscript. He is frequently styled "The father of French history."

**Duchess of Devonshire**, English noblewoman, made famous by two beautiful portraits, one by Reynolds and the other by Gainsborough. The latter, the more famous of the two, shows the lady wearing a broad-brimmed hat with plumes, that has come to be known as the Gainsborough hat. The picture is in the gallery of the New British Institution, replaced in 1902, after having been concealed since 1876, when it was cut from the frame by a noted American thief, since dead.

**Duchess, The**, the pen-name of MARGARET WOLFE HUNGERFORD (q.v.).

**Duck**, a general name for birds of the family *Anatida*, but more particularly restricted to a group of genera comprising *Anas*, *Spatula*, *Dafila*, *Querquedula*, *Mareca*, *Aix*, *Aythya*, *Fuligula*, *Harelda*, *Somateria*, etc. The ducks proper are distinguished from the swans (*Cyguina*), comprised in the same family, by having shorter necks; and from the geese (*Anserina*), also of the same family, by having shorter necks, and legs less strong and placed farther back. They also subsist largely on insects and other animal food, while the geese and swans live mostly on vegetable food. The voices of the three groups are also distinctive.

The family *Anatida* is the only one of the order *Anseres* and with the flamingoes (*Phenicoptera*) constitutes the *Chenomorpha* (q.v.). The bill is provided with marginal teeth or lamellæ, and is usually broad, flat, and covered with a soft, sensitive skin; the palate is of the desmognathous type, and the occipital region of the skull perforated with usually two fenestræ. With a very few exceptions they are strictly aquatic birds, characteristic of northern regions, where about half of the 180 known species occur. From 5 to 10 sub-families have been recognized by different authors. The simplest arrangement distinguishes the *Cyguina*, or swans; the *Anserina*, or geese; the *Anatina*, or river ducks, with the bill flattened and the hallux unlobed; the *Fuligulina*, or sea ducks, with flattened bill and lobate hallux; and the *Mergina*, or fish-eating ducks, with long, slender, and cylindrical bill, and lobed hallux. Of the last three sub-families, which include all of the ducks, about 40 species belong to the fauna of North America. The following accounts will serve to illustrate the habits and economic importance of some of the most noteworthy.

The mallard, or common wild duck (*Anas boschas*) is found throughout the northern hemisphere, except in the tropics, and breeds throughout the greater part of its range. This is the original stock of the domesticated duck, and appears to have been reclaimed at a very early period. It is found in nearly every fresh-water lake and river of the central United States, northern Europe, and Great Britain. The nest is usually placed by the side of a stream or lake, or in a marsh or bog, among close grass, reeds, and rushes, and may often contain from 12 to 16 eggs, of a dull greenish-white. The flesh of the wild duck is

held in general estimation, and various methods are resorted to in order to obtain these birds in quantities. In Picardy, France, vast numbers are taken in decoys, or ingeniously arranged netted enclosures, and sold in the Paris market, where, in one season, 30,000 francs have been paid for the produce of a single small lake. They also abound in the Fen District, Lincolnshire, England, and formerly were taken in great quantities by similar means as in Picardy. The number taken in England by means of decoys has greatly decreased, however. In the United States various simple contrivances are made use of for the capture of these wary birds. In some ponds frequented by them five or six wooden figures, called decoys, cut and painted to represent ducks, and sunk by pieces of lead nailed to the bottom, so as to float at the usual depth on the surface, are anchored in such a position as to be within easy range of a sportsman concealed among brush, etc. These attract the passing flocks, which alight, and thus expose themselves to certain destruction. In winter, when detached pieces of ice are occasionally floating in the river, some of the sportsmen on the Delaware paint their boats white, and laying themselves flat in the bottom, direct them almost imperceptibly near a flock before the ducks have distinguished them from a floating piece of ice. For this purpose low boats sunk deep in the water and known as sneak boxes are used. On land another stratagem is sometimes practised with great success. A tight hogshhead is sunk in the marsh or mud near the place where ducks are accustomed to feed at low water, and where otherwise there is no shelter; the edges and top are artfully concealed with tufts of long, coarse grass, and reeds or sedge. From within this blind the sportsman watches his collecting prey, and usually commits great havoc. In China the sportsman covers his head with a calabash, pierced with eye-holes, and thus equipped wades into the water, keeping only his head above the surface, and on arriving amid a flock, seizes them by the legs, fastens them to his girdle, and thus takes as many as he wishes, without disturbing the rest.

The black duck (*Anas obscura*) is much more abundant than the mallard in eastern North America, and has a much less extensive north and south range. It breeds in the northern United States and as far north as Labrador. Like the mallard, it is properly a fresh-water duck, but during the late fall and winter frequents the salt marshes and feeds on shell-fish. Great numbers are shot over decoys and from blinds and supplied to the New York and Philadelphia markets. In this species the sexes are similar, while in the mallard the male is larger and much more brightly colored, and is designated the drake, the name duck being restricted to the female.

Musk duck, erroneously called Muscovy duck (*C. moschata*). This well-known bird is the largest of the duck kind, and approaches nearly to the size of a goose. It has obtained its name from a strong smell of musk which exhales from its body, and not because it comes from Russia, as has been supposed, since it is a native of South America. The musk ducks are tamed in great quantities in the West Indies, and are found wild in Guiana, where they nestle on the trunks of trees, close upon the water's edge.

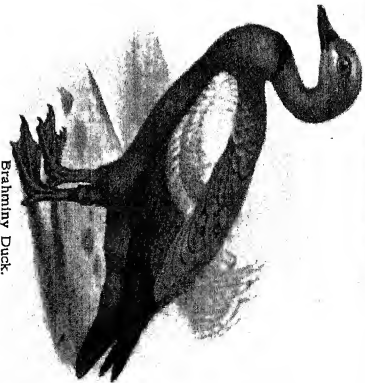
DUCKS.



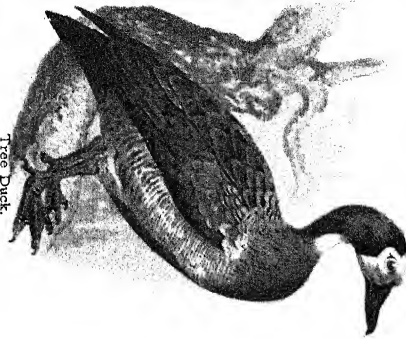
Sheldrake



Wild Duck or Mallard.



Brahmany Duck.



Tree Duck.



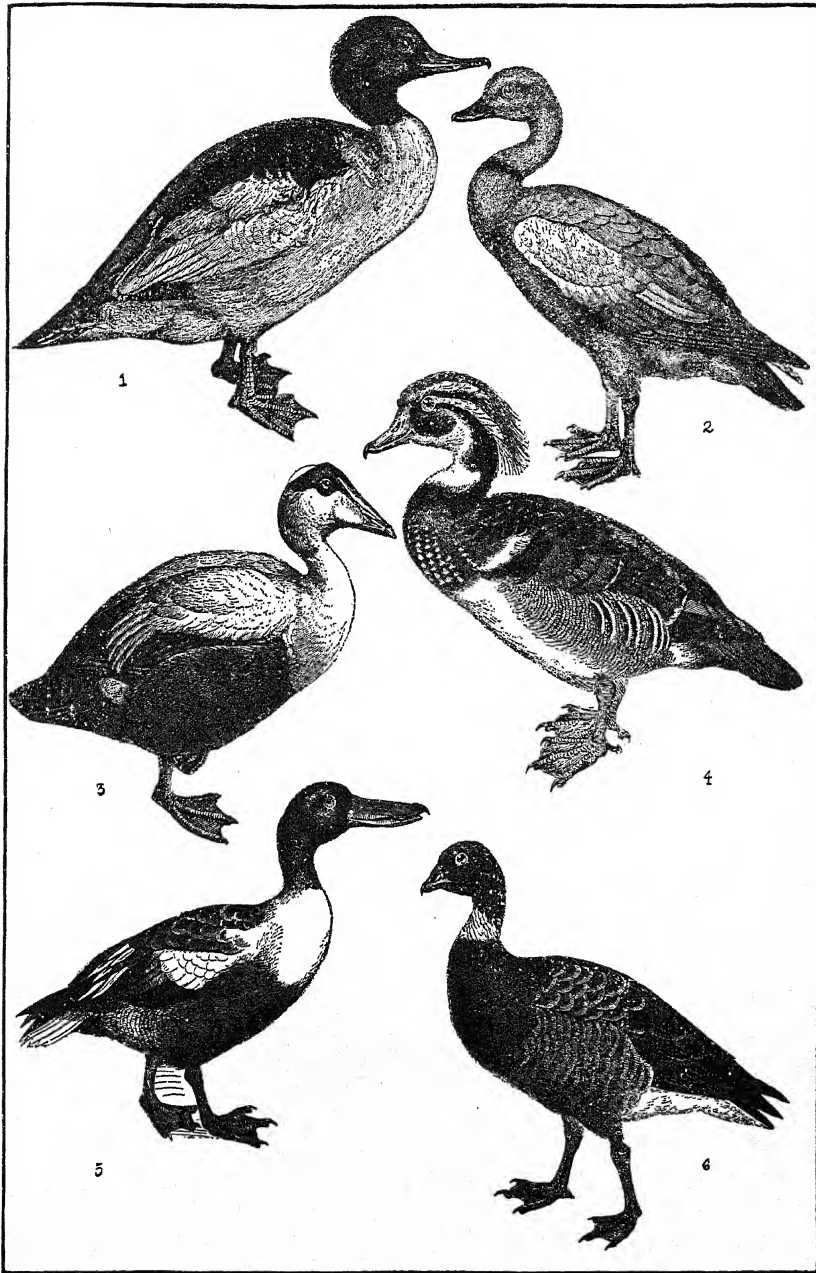
Elder Duck.



Wood Duck.



REPRESENTATIVE DUCKS AND GEESE.



1. Goosander (*Mergus merganser*).
2. Brahminy Duck (*Tadorna casarca*).
3. Elder (*Somateria mollissima*).

4. Wood Duck (*Aix sponsa*).
5. Shoveler (*Anas clypeata*).
6. Bernicle Goose (*Branta bernicla*).





## DUCK — DUCKBILL

They feed much upon a plant called wild rice, and are difficult to approach.

Canvas-back duck (*Aythya vallisneria*), a delicious duck peculiar to America, was known to the epicure long before it was described by the naturalist. We are indebted to Wilson for the first account of it. He gave it the name of the plant on which it feeds, which had been called after the celebrated Vallisneri. The canvas-back ducks arrive in the United States from their breeding grounds in the north about the middle of October, and, though common throughout the United States, their most famous assembling place is in the numerous rivers in the neighborhood of Chesapeake Bay. On the Susquehanna they are called canvas-backs, on the Potomac white-backs, and on James River shel-drakes. When they first arrive they are very lean; but from the abundance of their favorite food they become fat about November. Formerly they were sometimes found in such multitudes as to cover several acres in a compact flock, but by the use of the swivel gun and night shooting, a practice now prohibited by law, their numbers have been greatly depleted. From the great demand for these ducks and the high price they always command, various methods are employed to decoy them within gunshot. The most successful is that termed tolling, in which they are enticed to approach the shore by means of a dog properly trained. The canvas-back is constantly attended by another species, the American widgeon (*M. americana*), which manages to make a good subsistence from his labors. This bird is extremely fond of the tender roots of that particular species of plant on which the canvas-back feeds. The widgeon, which never dives, watches until the canvas-back rises, and before he has his eyes well opened, snatches the morsel from his mouth, and makes off.

Among other species of ducks are, *Spatula clypeata*, or shoveller, remarkable for the strange form of its bill; *Chaulelasmus strepera*, or gad-wall, which is nearly cosmopolitan but more rare in America than in Europe; *Dafla acuta*, pintail or sprigtail, remarkable for the form of its tail, abundant in both hemispheres; and *Aix sponsa*, summer or wood duck, not more remarkable for its great beauty, in which it stands pre-eminent, than for its habit of nesting in hollow trees. The sub-genus *Nettion* includes the several species of teal, and *Somateria*, the eider ducks. *Oidemia fusca*, velvet duck, found in both hemispheres, has a rank and fishy flavor and is therefore seldom sought after; and *O. americana*, the scoter found in America. These, with a few other birds of the same fishy flavor, are exempted from the interdict which forbids Roman Catholics the use of animal food on certain days, on the supposition of their being cold-blooded and partaking of the nature of fish. *A. americana*, the red-head, and *A. ferina*, the European pochard, approach very near to the canvas-back in appearance and habits. *Fuligula marila*, scaup-duck or blue-bill, is a well-known and common species in both continents. *Clangula hyemalis*, long-tailed duck or old-wife, common to both continents, is remarkable for the long and slender middle feathers of its tail; and *Clangula histrionica*, harlequin-duck, a magnificent species found on both continents, derives its name from the singularity of its markings;

along the coast of New England it is called "the lord."

The duck bred for domestic purposes is derived chiefly from the mallard, crossed in some cases, with either the gadwall, the musk, or the black duck. One of the best-known and most esteemed varieties of domestic duck is the Aylesbury duck, so named from the town in Buckinghamshire, England, where they are largely raised for the London market. They are noted for their size, fine white and downy feathers, and delicately flavored flesh. They are easily raised and very productive, being early layers and accurate hatchers.

Additional information will be found in the articles, canvas-back, dusky duck, eider, gadwall, golden-eye, long-tailed duck, mallard, red-headed duck, ruddy duck, scaup, scoter, shoveller, shel-drake, teal, and widgeon. Consult also: Baird, Brewer, and Ridgway, 'Water-birds of North America'; Salvadori, 'Catalogue of Ducks of the British Museum'; Darwin, 'Animals and Plants Under Domestication'; and Sanford, Bishop, and Van Dyke, 'The Water Fowl Family.'

**Duck**, a species of strong linen cloth, lighter and finer than canvas, used for small sails and for men's wear. Duck is usually white or unbleached, but is sometimes made in plain colors.

**Duck Ant.** See WHITE ANT; TERMITE.

**Duckbill**, or **Platypus**, an aquatic egg-laying mammal (*Ornithorhynchus paradoxus*) native to the sluggish rivers of Australia, Papua, and Tasmania. Its entire length from tip of bill to tip of tail is usually between 18 and 20 inches. Its body is rather long, and covered with glossy blackish hair, close to the roots of which is a soft waterproof under-coat of fur similar to that of the beaver. The head is rounded; the eyes are small and bright; and there are no external ears, despite which fact, the creature's hearing is very acute. The feature which gives its name to the animal is the duck-like bill which is the substitute for the muzzle of other animals. This bill is formed of the elongated jaw-bones, covered with a highly sensitive, smooth skin; when the teeth are shed, as they are at maturity, horny plates, developed on both jaws, take their place and do their work. The duckbill is well adapted to its aquatic and burrowing habits. Its legs are short, its feet webbed and furnished with sharp claws. In the fore-feet the web extends far beyond the claws, but can be folded back out of their way. The tail is broad and flattened, covered with coarse hair, and nearly naked on the other side. In habits the duckbill is almost entirely aquatic, spending its life in or near rivers; but carefully avoiding stagnant or brackish waters. In swimming it propels itself mainly by the aid of its fore-feet; and it dives well. It is gregarious; and sometimes congregates in considerable numbers; but is so shy that unless one watches quietly at evening he will not see a single member of the company. The least hint of danger sends them all to the bottom. The food is often collected in the large cheek pouches, where it can be stored and conveniently carried home by the animal. Each pair lives in a burrow in the bank—a gallery or passageway, widened out at its interior extremity into a chamber where the occupants sleep by day, and whither the

## DUCKETT — DUCTILITY

female retires to produce her young. She lays few eggs in her bed of dry grass; often only one, and hatches her young in a comparatively short time. When born they are naked and blind. The eggs are white, about three fourths of an inch long, by one half inch wide; and unlike birds' eggs, have a soft and somewhat flexible shell; though, in their having a large amount of food-yolk, they resemble birds' eggs. The food consists of aquatic insects, crustaceans and worms, which live in the water or in the mud, and which are found not only by the tactile sense, in the bill, but also by the unusually keen sense of smell. The voice is like the growl of an angry puppy, but the disposition is quiet and gentle.

**Duck'ett, Sir Floyd**, English archæologist: b. 1811; d. 13 May 1902. His 'Technological Military Dictionary' published (1848) in German, English and French, brought him gold medals from Austria, Prussia and France. His 'Reminiscences' appeared in 1894.

**Ducking Stool**, also known as "cucking stool" and "castigatory," a chair in which common scolds were formerly securely fastened, to receive the punishment of being ducked in water. The culprit was placed in the chair with arms drawn backward; a bar was placed across the back and inside the elbows, while another bar held the body upright; in this uncomfortable position the prisoner was securely tied with cords. The persons appointed to carry out the punishment, by raising their end of the beam, caused the unfortunate culprit to go overhead into the water. By pulling down their end with a chain the victim was once more brought to the surface. The ducking stool was generally used in Great Britain from the 15th to the 18th century, and one case was known as late as 1806.

**Duckweed**, a genus of plants, by some botanists made the type of the small order *Lemnaceæ*. The species are small plants which float on the surface of stagnant ponds or slow running streams, and are eaten by ducks and geese. The fronds take the place both of the stems and leaves, and are usually of a bright green color. The flowers arise from a slit just below the margin of the frond. The family comprises the very smallest of the flowering plants, and contains three genera, all of which are to be found in North America. Of the 26 species in the family, the most numerous in the United States are those of the genus *Lemna*, of which five are found. The other genera are *Spirodela* and *Wolffia*.

**Duckworth, Sir John Thomas**, English admiral: b. Leatherhead, Surrey, 28 Feb. 1748; d. Devonport, England, 31 Aug. 1817. Between 1776 and 1779 he served in America. He distinguished himself in 1794 in the great naval victory gained by Lord Howe off Ushant, and in 1798, under Earl St. Vincent, acquired new fame at the capture of Minorca. Some years later he set out in pursuit of a French fleet which had sailed to the West Indies to succor St. Domingo. He came up with it and succeeded in capturing an 80 and three 74 gun ships. For this service he received the thanks of both houses of Parliament, and was presented by the city of London with its freedom and a sword of the value of 200 guineas; and by the assembly of Jamaica with thanks and a sword of the

value of 1,000 guineas. In 1807, having been appointed to watch the Turkish fleet, he forced the passage of the Dardanelles. Between 1810 and 1815 he was governor of Newfoundland.

**Duclerc, Charles Théodore Eugene**, shārl tā-ō-dōr è-zhān dü-klārk, French statesman: b. Bagnères-de-Bigorre, France, 9 Nov. 1812; d. Paris 21 July 1888. He took an active part in the Revolution of 1848; was a speaker in the Constituent Assembly, and minister of finance for a time. He was elected vice-president of the National Assembly in 1875; chosen a senator for life in the same year; and became premier in 1882.

**Duclos, Charles Pinot**, shārl pē-nō dü-klō, French historian and novelist: b. Dinant, Brittany, 12 Feb. 1704; d. Paris 26 March 1772. He was chosen member of the Academy of Inscriptions in 1739, and in 1747 member of the French Academy, of which he was afterward appointed permanent secretary. In 1750 he was appointed to succeed Voltaire as historiographer of France. Among the best of his novels are 'Confessions du Comte de Bellipse' (1741). His 'Considérations sur les Mœurs de ce Siècle' are full of striking sketches of character and deep knowledge of human nature. His 'History of Louis XI.' is esteemed, but shows the hand of the novelist. Of more value are his 'Mémoires secrets sur les Règnes de Louis XIV. et XV.' This work was composed in his character of historiographer. He also distinguished himself in his 'Remarques sur la Grammaire générale de Port Royal' as a grammarian.

**Ducornet, Louis César Joseph**, loo-ē sā-zār zhō-zéf dü kōr-nā, French artist: b. Lille 10 Jan. 1806; d. Paris 27 April 1856. Born without arms, he learned in early childhood to use his feet for hands, and when 13 years old showed such skill in drawing with his toes that Watteau received him as a pupil in the Lille Academy of Design. There his ambition to become a painter received wholesome encouragement. At the end of three years he took the first prize for a drawing of the human figure from life, and received a pension from the city which the government subsequently increased. He then went to Paris for more advanced study, painted 'The Parting of Hector and Andromache' (1828), and presented it to his native city. He continued painting till within a few weeks of his death. His last work of note, 'Edith Finding the Body of Harold,' was ordered by Napoleon III. and exhibited in 1855.

**Ductilim'eter**, an instrument invented by M. Regnier for ascertaining the relative ductility of metals. The metal to be tested is subjected to the action of blows from a mass of iron of given weight attached to a lever, and the effect produced is shown upon a graduated arc.

**Ductil'ity**, the quality of adaptedness of solid bodies, particularly metals which render them capable of being extended by drawing; as malleability is for being beaten into leaves. The order of metals in these two respects is as follows: ductility—gold, silver, platinum, iron, copper, zinc, tin, lead, and nickel; malleability—gold, silver, copper, tin, platinum, lead, zinc, iron, and nickel. The less ductile soft metals, such as magnesium, which cannot be drawn, are converted into wire by the process of press-

ing or squirting. When glass is subjected to a sufficient degree of heat it can be managed like soft wax, and may be drawn out into threads exceedingly long and fine. Ordinary spinners do not form their threads of silk, flax, or the like, with half the ease and expedition the glass-spinners do threads of this ordinarily brittle matter. Some of them are made into plumes of filaments much finer than hair, which bend and wave, like hair, with every wind. Two workmen are employed in making them: the first holds one end of a piece of glass over a flame, and when the heat has softened it the second operator applies a glass hook and draws out a thread of glass, which still adheres to the mass; then fitting his hook on the circumference of a wheel about  $2\frac{1}{2}$  feet in diameter, he turns the wheel as fast as he pleases till it is covered with a skein of glass thread. The parts, as they recede from the flame, by gradually cooling become more cohesive, the parts nearest the fire are least cohesive, and consequently must give way to the effort made to draw them toward the wheel. These threads are commonly of a flat, oval shape, being three or four times as broad as thick; some of them seem scarcely bigger than the thread of a silk-worm, and are surprisingly flexible. If the two ends of such threads are knotted together they may be drawn and bent till the aperture or space in the middle of the knot does not exceed one fourth of a line or one forty-eighth of an inch in diameter. The flexibility of glass increases in proportion to the fineness of the threads; and, probably, had we the art of drawing threads as fine as those of a spider's web, we might weave stuffs and cloths of them.

**Duda, Dudka, or Dudotka**, the name of a singular wooden wind-instrument used in some parts of Russia, consisting of two tubes of different length, each with three sound-holes and having a single mouth-piece, thus somewhat resembling the double flute of the ancients.

**Dude**, a modern word coined as a slang expression (but now, by constant use, dignified into semi-respectability) to designate a brainless fop, whose whole business and aim in life are like those of Carlyle's dandy — to wear clothes. The term is said to have originated in London about 1882, at the time of the so-called "æsthetic" movement in dress and manners among the ultra-society folk.

**Du Deffand, Madame.** See **DEFFAND**.

**Dudevant, düd-vân, Madame.** See **SAND, GEORGE**.

**Dudley, Benjamin Winslow**, American surgeon: b. Spottsylvania County, Va., 20 April 1785; d. Lexington, Ky., 20 Jan. 1870. He received his medical education at the medical school of the University of Pennsylvania in Philadelphia, and in 1810 went to Europe for the further study of his profession, where he remained as the pupil of Sir Astley Cooper, Abernethy and others, in London, and Larrey, Dubois, and Boyer till 1814. On his return he established himself in Lexington, Ky., in July 1814, and on the day of commencing practice performed two difficult operations, that for strangulated hernia, and trephining in a case of fractured skull. He became especially noted for his success as a lithotomist.

**Dudley, Charles Edward**, American politician: b. Johnson Hall, Staffordshire, England, 23 May 1780; d. Albany, N. Y., 23 Jan. 1841. After the death of his father he came with his mother to Newport, R. I., in 1784. In 1811 he removed to Albany. He was State senator 1820-5, mayor of Albany in 1821 and 1823, and in 1829 was appointed United States senator to serve out the unexpired term of Martin Van Buren. He was particularly fond of astronomical science, and his widow in 1856 founded the Dudley Observatory at Albany.

**Dudley, Sir Edmund**, English politician: b. about 1462; d. London 18 Aug. 1510. He was an instrument of Henry VII. in the arbitrary acts of extortion by the revival of obsolete statutes and other unjust measures practised during the latter years of his reign. On the accession of Henry VIII. he was arrested for high treason and perished on the scaffold with his associate, Sir Richard Empson.

**Dudley, Lord Guildford**, English noble: d. London 12 Feb. 1554. He was a son of John, Duke of Northumberland, and was married in 1553 to Lady Jane Grey, whose claim to the throne the Duke intended to assert on the death of Edward VI. On the failure of the plot Lord Guildford was condemned to death, but the sentence was not carried into effect till the insurrection of Wyatt induced Mary to order his immediate execution.

**Dudley, Sir Henry Bate**, English clergyman and author: b. Fenny Compton, Warwickshire, 25 Aug. 1745; d. 1. Feb. 1824. Not finding the emoluments of his curacy sufficient for his convivial tastes, he turned his attention to literature, established several newspapers, among others the *Morning Post* and *Morning Herald*, and also wrote some dramatic works. His original name was Henry Bate, but in accordance with the will of a relative who left him some property, he assumed in 1784 that of Dudley. He was made a baronet in 1812.

**Dudley, John, DUKE OF NORTHUMBERLAND and EARL OF WARWICK**: b. 1502; d. London 22 Aug. 1553. He was a son of Sir Edmund Dudley (q.v.). Under Edward VI. he manifested the most insatiable ambition and obtained vast accessions of honors, power, and emoluments. The illness of the king, over whom he had gained complete ascendancy, aroused his fears, and he endeavored to strengthen his interest by marrying his son, Lord Guildford Dudley, to Lady Jane Grey, descended from the younger sister of Henry VIII., and persuaded Edward to settle the crown on his kinswoman by will, to the exclusion of the Princesses Mary and Elizabeth. The death of the king, the abortive attempts to place Lady Jane Grey on the throne, and the ruin of all those concerned in the scheme are among the most familiar events in the annals of England.

**Dudley, Joseph**, American colonial governor of the province: b. 23 Sept. 1647; d. Roxbury 2 April 1720. He was a son of Thomas Dudley (q.v.). He was graduated at Harvard College in 1665, served in the Indian war in 1675, was sent to England as agent for the province in 1682, appointed president of New England in 1686, superseded by Andros a few months later, and made chief justice. He was chief justice of New York from 1690 to 1693,

## DUDLEY — DUE PROCESS OF LAW

then eight years lieutenant-governor of the isle of Wight, and finally governor of Massachusetts from 1702 to 1715.

**Dudley, Paul**, American colonial chief justice: b. 3 Sept. 1675; d. Roxbury, Mass., 21 Jan. 1751. He was a son of Joseph Dudley (q.v.). He was graduated at Harvard College in 1690, and afterward studied law in London. He returned to Massachusetts in 1702, with the commission of attorney-general; in 1718 was appointed judge, and in 1745 became chief justice. By his will he bequeathed £100 to Harvard College, the interest of which was to be applied to the support of an annual lecture. This lecture is called from its founder the Dudleian lecture, and, according to his direction, is delivered on one of four subjects which are treated of in succession.

**Dudley, Plimmon Henry**, American metallurgical engineer: b. Freedom, Ohio, 21 May 1843. He was chief engineer of Akron, Ohio, 1868-72, and subsequently invented the dynamograph (1874), the track indicator (1880), and the streamatograph for obtaining and registering stresses in rails.

**Dudley, Robert**, EARL OF LEICESTER, English courtier: b. 24 June 1532 or 1533; d. Cornbury, Oxfordshire, 4 Sept. 1588. He was a son of John Dudley, Duke of Northumberland, and though involved in the criminal designs of his father, and included in the sentence of attainder passed against him on the accession of Mary, was pardoned and employed by that queen. After Elizabeth ascended the throne Dudley soon acquired the distinction of being her favorite. Offices, honors, and wealth were showered on him with an unsparing hand. He was appointed master of the horse, knight of the Garter, and privy counselor; and received grants of the princely domains of Kenilworth, Denbigh, and Chirk Castle. In 1564 he was created Baron Denbigh and Earl of Leicester, and was the same year elected chancellor of Oxford University, having previously been chosen to the same office at Cambridge. In 1588 he was appointed captain-general of the queen's forces to resist the Armada.

**Dudley, Thomas**, American colonial governor: b. Northampton, England, 1576; d. Roxbury, Mass., 31 July 1652. He came to Massachusetts in 1630 with the commission of deputy governor, and he was afterward chosen governor in the years 1634, 1640, 1645, and 1650. He was a man of integrity and piety, though intolerant, like most of his generation. See Jones, 'Life and Work of Thomas Dudley' (1899).

**Dudley, Thomas Underwood**, American Protestant Episcopal bishop: b. Richmond, Va., 26 Sept. 1837; d. New York 22 Jan. 1904. He was graduated from the University of Virginia in 1858, and served in the Confederate army during the Civil War, attaining the rank of major. Completing his studies at the Virginia Theological Seminary he was ordained in 1868 and after filling the rectorship of Christ Church, Baltimore, was made assistant bishop of Kentucky in 1875, and became bishop of the diocese 1884. He has published: 'A Wise Discrimination of the Church's Need.'

**Dudley, William Lofland**, American scientist: b. Covington, Ky., 16 April 1859. He was graduated at the University of Cincinnati in

1880, and from 1880 to 1886 was professor of chemistry and toxicology at Miami College. His iridium process for electroplating is very successful. Since 1886 he has been professor of chemistry at Vanderbilt University, being also dean of the medical department.

**Dudley, William Russel**, American botanist: b. Guilford, Conn., 1 March 1849. He was graduated at Cornell in 1874, becoming assistant professor of botany there in 1876. Since 1892 he has been professor of botany at Leland Stanford, Jr., University. He is the author of 'Cayuga Flora'; and 'Manual of Histology.'

**Dudley, England**, city, parliamentary borough in Worcestershire. Among its institutions are a mechanics' institute and a geological society, with a museum rich in mineral specimens, and a free library and school of art. It is situated in the midst of the "black country," with extensive coal fields surrounding it. The principal manufactures are articles made from iron and also flint-glass. There are here the remains of a castle, said to have been founded in the 8th century by a Saxon prince called Dudo or Dud, who has given the town its name. Pop. (of parliamentary borough) 97,000.

**Dudley Diamond, The**, a diamond found in South Africa in 1868, weighing originally 89 carats, but reduced to half that weight in cutting. It receives its name from its owner, the Earl of Dudley, who bought it for \$150,000. See DIAMOND.

**Dudweiler**, dood'vī-lér, Germany, town in Rhenish Prussia, about 45 miles northeast of Metz. The coal fields near by are a source of wealth to the town; and the chief manufactures are iron works and potteries. In the vicinity is Brennender Berg (Burning Mountain), a mountain composed largely of coal which has been burning for over 200 years. Pop. 16,514.

**Due Process of Law**, law in its regular course of administration through courts of justice. This term, due process of law, which occurs in the amendments to the Constitution of the United States (Art. V.), and in the constitutions of nearly all of the States, is considered by Coke as equivalent to the phrase "law of the land" (used in Magna Charta, ch. 29), and is said by him to denote "indictment or presentment of good and lawful men." Coke Inst. 50. Due process of law includes notice, hearing, and judgment. The constitutions of the various States and the Federal Constitution contain no description of those processes which it was intended to allow or forbid. As a general rule they do not even declare what principles are to be applied to ascertain whether it be due process. It is manifest that it was not left to the legislative power to enact any process which might be devised. As used in the Constitution of the United States, the article is a restraint on the legislative as well as on the executive and judicial powers of the government, and cannot be so construed as to leave Congress free to make any process, "due process of law," by its mere will. It has been held that the amendment to the Constitution of the United States does nothing more than declare a great common law principle applicable to all governments, both State and Federal, which has existed from the time of Magna Charta. It was held by the Supreme Court of the United States in *Murray v. Hoboken Co.*, 18 How. 272,

## DUEL

that the words "due process of law" were undoubtedly intended to convey the same meaning as the words "law of the land" in Magna Charta. Due process of law ordinarily implies and includes a complainant, a defendant and a judge, regular allegations, an opportunity to answer, and a trial according to some settled course of judicial proceeding. When applied to proceedings in criminal cases, the expression "due process of law," or the "law of the land," means that no person shall be deprived of life, liberty, property, or privileges, without indictment or presentment by "good and lawful men," selected, organized, and qualified in accordance with some pre-existing law, and a trial by a court of justice, according to the regular and established course of judicial proceedings. It is to be regretted, however, that the constitutional meaning or value of the phrase "due process of law" remains to-day without that satisfactory precision of definition which judicial decisions have given to nearly all the guarantees of personal rights found in the constitutions of the several States and of the United States.

**Duel** (from *duellum*, derived from *duo*) is a combat between two, at a time and place appointed in consequence of a challenge, and so is distinguished from an encounter taking place without any previous arrangement. The custom of dueling was derived from the Germans, Danes, and Franks, who carried the practice of the judicial combat so far that none were excused except women, sick people, cripples, and such as were over 60 years of age. Even ecclesiastics and monks were obliged to maintain their controversies by a champion in arms; and this singular species of jurisprudence was not confined to criminal accusations, but the titles to estates were decided in the same manner. At length, however, this mode of trial was limited to those accusations of capital offenses in which there was no other testimony, and in which common fame pronounced the accused party to be guilty. The party vanquished was punished by hanging, beheading, or mutilation of members. A judicial combat was authorized by Gundebald, king of the Burgundians, as early as 501 A.D. The practice of trying rights to land, as well as the guilt or innocence of an accused party, by combat under judicial authority, very naturally suggested the decision of personal quarrels in the same way, and all cases in which there was no adequate redress provided in the ordinary tribunals.

The example of Francis I. of France and Charles V. of Spain gave a sanction to this mode of arbitration. On the breaking up of the treaty between these sovereigns and the declaration of war by the French and English heralds at the court of Charles, 2 Jan. 1528, the emperor, in replying to the declaration of the French monarch, desired the herald to acquaint his sovereign that he would henceforth consider him not only as a base violator of public faith, but as a stranger to the honor and integrity becoming a gentleman. On receiving this message Francis immediately sent back the herald with a cartel of defiance, gave the emperor the lie in form, challenged him to single combat, and required him to appoint the time, place, and weapons. Charles accepted the challenge; but after many messages concerning the arrangements for the combat, accompanied with mutual reproaches bordering on the most indecent scurrility, all

thoughts of the duel were given up. But this affair, though it thus terminated without any rencounter, is supposed to have had a great influence in producing an important change in manners all over Europe. Upon every insult or injury which seemed to touch his honor a gentleman thought himself entitled to draw his sword, and to call on his adversary to give him satisfaction. Dueling raged with the greatest violence in France, where it is calculated that 6,000 persons fell in duels during 10 years of the reign of Henry IV. His celebrated minister, Sully, remonstrated against the practice; but the king connived at it, supposing that it tended to maintain a military spirit among his people. But afterward, in 1602, he issued a very severe decree against it, and declared it to be punishable with death; and at the same time commanded any person who had suffered wrong or received an insult to submit his case to the governor of the province, in order that it might be considered by a tribunal consisting of the constables and marshals of France. This decree, however, accompanied by the institution of a tribunal of honor, did not put an end to duels in France. Richelieu was firm in carrying out all edicts by which he hoped to check the power of the nobility, and accordingly insisted on the strict observance of those against duels. Under his ministry the Count of Bouteville-Montmorency suffered death in 1627 for having violated a decree of the French parliament against dueling. This had for a time the effect of deterring others from engaging in this practice. During the minority of Louis XIV. the law was more feebly administered, and more than 4,000 nobles are said to have lost their lives in duels. With the revolution of 1789 commenced the period of legal impunity for duels, and a new class of duels became common, those, namely, between men engaged in politics. Bills, with a view to put down the practice, were brought forward in the chambers in 1829 and 1830, and a similar proposal was made to the Council of State in 1832; but they were not accepted. At last, in 1837, the court of cassation determined to follow a new law with regard to duels, and protesting against the practice in the name of morality and law, it decided that in case of death or injury resulting from a duel, the principal parties and the seconds should be proceeded against and punished in accordance with the general provisions of the *code pénal*. The French courts, however, reserve to themselves a discretionary power in dealing with cases of dueling, and the practice is by no means yet obsolete in France.

Single combats are said to have been introduced into England by the Normans. In the time of chivalry numerous single combats took place in England, which, in the proper sense of the term, can scarcely be called duels. It may be said that the duel, strictly so called, was introduced into England about the same time that it became common in France, such was the contagion of the example of Francis I. and Charles V. In the reign of James I. of England there were numerous cases of dueling, the most celebrated of which is that in which Lord Bruce and Lord Sackville (afterward Lord Dorset) were the principals, and in which the former was killed. Cromwell was an enemy of the duel, and during the protectorate there was a cessation of the practice. It came again into vogue, however, after the Restoration, thanks



chiefly to the French ideas that then inundated the court of St. James. Some of the duels of that epoch are in perfect accord with the loose morality then prevalent. An instance of this is the duel in which the Duke of Buckingham killed the Earl of Shrewsbury, while the wife of the latter, the cause of the duel, who had accompanied the Duke to the ground, witnessed the encounter in the dress of a page. A striking thing is that as society became more polished in England, duels became more frequent. They were never more numerous than in the reign of George III. Among the principals in the fatal duels of this period were Charles James Fox, Sheridan, Pitt, Canning, Castlereagh, the Duke of York, the Duke of Richmond, and Lord Camelford. The last-mentioned was the most notorious duelist of his time, and was himself killed in a duel in 1804. Of all the duels which took place during the reigns of George IV., William IV., and Queen Victoria, the most celebrated is that which was fought between the Duke of Wellington and Lord Winchelsea in 1829, the cause of which was certain animadversions which Lord Winchelsea had passed on the Duke's conduct in connection with the Catholic Emancipation Bill. The duel passed off without any injury being done to either of the parties engaged. The Duke of Wellington missed his aim, whereupon Lord Winchelsea fired into the air and apologized. Since that time the practice may almost be said to have become extinct in England. Even in the army dueling is now rare, since the offense is now one for which any person concerned in it may be tried by court-martial.

In Germany the practice of dueling is not yet extinct. Indeed in the army it is recognized by law as having a certain defined position. It is still also not uncommon at the German universities, though the duels of the students are seldom serious affairs, being rather fencing matches with sharp weapons than duels proper. The combatants are generally padded all over the body except the face and sword-arm.

Dueling has been known in the United States from the very beginning of their settlement, the first duel taking place in 1621, at Plymouth, between two serving men. In 1728, a young man named Woodbridge was killed in a duel on Boston Common, by another young man named Phillips. They fought without seconds, in the night time, and with swords. Aided by some of his friends, Phillips got on board a man-of-war and escaped to France, where he died a year afterward. There were few duels in the Revolution, the most noted being those between Gen. C. Lee and Col. John Laurens, in which the former was wounded, and between Gens. Cadwallader and Conway, in 1778, in which the latter received a shot in the head from which he recovered. Button Gwinnett, one of the signers of the Declaration of Independence, from Georgia, was killed in a duel with Gen. McIntosh, in May 1777. In 1785 Capt. Gunn challenged Gen. Greene twice, both being citizens of Georgia, and threatened a personal assault when the latter refused to meet him. Greene wrote to Washington, acknowledging that if he thought his honor or reputation would suffer from his refusal he would accept the challenge. He was especially concerned as to the effect of his conduct on the minds of military men, and admitted his regard for the opinion of the world. Wash-

ington approved of his course in the most decisive terms, not on moral grounds, but because a commanding officer is not amenable to private calls for the discharge of his public duty.

Alexander Hamilton was killed in a duel with Aaron Burr in 1804, the latter being Vice-President, and the former the greatest leader of the opposition. This duel is always allowed the first place in the history of American private combats. That which stands next is the duel between Capts. Barron and Decatur, the latter being killed, and Barron severely wounded. Henry Clay and John Randolph fought in 1826, and Col. Benton, in closing his account of the fight, says: "Certainly dueling is bad, and has been put down, but not quite so bad as its substitute—revolvers, bowie knives, blackguarding, and street assassinations under the pretext of self-defense." Gen. Jackson killed M. Dickinson in a duel, and was engaged in other "affairs." Col. Benton killed a Mr. Lucas, and had other duels. In 1841 Mr. Clay was on the eve of fighting with Col. King, then a senator from Alabama, and elected Vice-President in 1852. Mr. Cilley of Maine fought with Mr. Graves of Kentucky in 1838, near Washington, and the former was killed. This duel caused nearly as much excitement as that between Hamilton and Burr. Both parties were members of Congress. Duels have been numerous in California, notably the combat between Terry and Broderick. Formerly they were very common in the United States navy, and valuable lives were lost. It is related of Richard Somers, who perished in the *Intrepid*, and who is said to have been a mild man, that he fought three duels in one day. In 1830 President Jackson caused the names of four officers to be struck from the navy roll because they had been engaged in a duel. Since the Civil War stringent laws have been passed in all the States against dueling and the practice has become obsolete in this country.

*Bibliography.*—Douglas, 'Duelling Days in the Army' (1887); Massi, 'History of Duelling in All Countries' (1880); Milligen, 'History of Duelling' (1841); Steinmetz, 'The Romance of Duelling' (1868); Truman, 'The Field of Honor' (1884).

**Duer, dü'ér, John**, American jurist: b. Albany, N. Y., 7 Oct. 1782; d. Staten Island 8 Aug. 1858. He commenced the practice of law in Orange County, N. Y., whence about 1820 he removed to the city of New York, where he resided until his death. In 1825 he was appointed one of the commissioners to revise the statute law of the State, and in 1849 was elected a justice of the superior court of New York, a position which he filled until his death. He published: 'Lecture on the Law of Representations in Marine Insurance' (1845); 'Law and Practice of Marine Insurance' (2 vols. 8vo, 1845-6), which has become a standard authority in the United States.

**Duer, William Alexander**, American jurist: b. Rhinebeck, Dutchess County, N. Y., 8 Sept. 1780; d. New York 31 May 1858. He was a brother of John Duer (q.v.). He was admitted to the bar in 1802, and between 1814 and 1820 was a member of the State assembly, taking a prominent part in the debates on the establishment of canals and other important questions. In 1822 he was appointed judge of the supreme court in the third circuit, an office which he held

until the close of 1829, when he was elected president of Columbia College. He retired from this post in 1842. He was the author of a treatise on the 'Constitutional Jurisprudence of the United States.'

**Duero.** See DOURO.

**Duez, Ernest**, ér nā dü-a, French painter: b. Paris 8 March 1843; d. there 5 April 1896. He was a pupil of Pils, and his paintings include: 'The Honeymoon'; 'Splendor and Misery'; 'St. Cuthbert'; 'Evening in Villerville'; 'The Pont-Neuf'; and 'In Summer.'

**Dufaure, Jules Armand Stanislas**, zhül är-män stän-ê-lâ dü-för, French orator and statesman: b. Saujon, France, 4 Dec. 1798; d. Paris 28 June 1881. He practised law at Bordeaux; entered the Chamber of Deputies in 1834, and became an influential leader of the Liberal party. Under the republic he was minister of the interior, but was driven from the public service by the *coup d'état* of 1851, and for the next 20 years devoted himself closely to his bar practice and pamphlet writing. Under the government of Thiers he acted as minister of justice; and in 1876, and again from 1877 to 1879, he was head of the cabinet.

**Duff, Alexander**, Scottish missionary: b. Perthshire 26 April 1806; d. Edinburgh 12 Feb. 1878. He set out in 1829 for India as the first Church of Scotland missionary to that country. He opened a school in Calcutta in which he sought to teach not only the doctrines of Christianity, but also the English language and the science and learning of Europe. He subsequently assisted in founding the University of Calcutta. His chief writings are: 'The Church of Scotland's India Mission' (1835); 'Vindication of the Church of Scotland's India Mission' (1837); 'India and India Missions' (1840); 'The Jesuits' (1845); 'The Indian Mutiny: Its Causes and Results' (1858).

**Duff, Edward Gordon**, English librarian: b. 16 Feb. 1863. He was educated at Cheltenham College and Oxford, and was librarian of the John Rylands Library, Manchester, 1893-1900. He was Sanders reader in bibliography in Cambridge University 1898-9, and 1902-3. He has published: 'Early Printed Books' (1893); 'Early English Printing' (1896); 'The Printers, Stationers, and Bookbinders of London' (1899); 'William Caxton' (1902).

**Duff, Mary Ann Dyke**, actress: b. London, England, 1794; d. New York 1857. She made her first appearance at the age of 14, and two years later, having married an actor named Duff, in the meantime, came to America, appearing as Juliet in Boston. With the exception of a short visit to England in 1828, the rest of her career was in America, where she appeared with the leading actors of the day in the tragedy roles of the stage. The elder Booth declared her to be the best actress in the world. Her last public appearance was in New Orleans in 1838. She married a Mr. Seaver of New Orleans, and spent nearly 20 years in retirement.

**Duff, Sir Mountstuart Elphinstone Grant**, English writer and politician: b. Eden, Aberdeenshire, 21 Feb. 1829. He was educated at Balliol College, Oxford, was called to the bar at the Inner Temple in 1854, and in 1857 entered the House of Commons. From 1868 till 1874 he held the

office of under-secretary for India under Mr. Gladstone, and in that statesman's second ministry he was under-secretary for the colonies from 1880 till his appointment in 1881 as governor of Madras. His tenure of this important office was very successful, and ended with his resignation in 1886. From 1889 till 1893 he was president of the Royal Geographical Society. His published works include: 'Studies in European Politics' (1866); 'A Political Survey' (1868); 'Elgin Speeches' (1871); 'Notes of an Indian Journey' (1876); 'Miscellanies, Political and Literary' (1879); 'Memoir of Sir Henry Sumner Maine' (1892); 'Ernest Renan' (1893); and 'Notes from a Diary' (1897-8-9-1900).

**Dufferin (düf'ér-in) and Ava, ä'va, Frederick Temple Hamilton-Temple Blackwood**, MARQUIS OF, Irish diplomatist and author: b. Ireland 21 June 1826; d. Clanboye, Ireland, 12 Feb. 1902. He first distinguished himself by contributions to literature, and published the popular 'Letters from High Latitudes' in 1859. He was successively under-secretary for India 1864-6, and for war 1866; was chancellor of the Duchy of Lancaster 1868-72; in 1871 was created an earl; and was governor-general of Canada 1872-8. His brilliant administration was remarkable for the wonderful development of the province of Manitoba. From 1879 to 1881 he was ambassador at St. Petersburg, whence he was transferred to Constantinople. In 1884 he succeeded Lord Ripon as viceroy of India, resigning in 1888. Lord Dufferin's tenure of office was made memorable by measures for strengthening the Indian frontier; by the various attempts to delimit the Afghan frontier; and, above, all, by the annexation of Upper Burma in December 1885. He became successively ambassador at Rome, marquis (1888), and ambassador to France (1891). In addition to the volume named he published: 'Irish Emigration and the Tenure of Land in Ireland' (1867); 'Speeches and Addresses' (1882); 'Speeches Delivered in India' (1890). His mother, Helen Selina Sheridan (1807-67) was the author of 'The Emigrant's Farewell'; 'O Bay of Dublin'; and other touching songs.

**Duffield, George**, American Presbyterian clergyman: b. Strasburg, Pa., 4 July 1794; d. Detroit, Mich., 26 June 1869. He held prominent Presbyterian pastorates in Philadelphia, New York, and Detroit, and was active as a leader of the "New School" Presbyterians.

**Duffield, George**, American Presbyterian clergyman and hymn writer: b. Carlisle, Pa., 12 Sept. 1818; d. Bloomfield, N. J., 6 July 1888. He was a son of the preceding. He was graduated at Yale in 1837, and at Union Theological Seminary, N. Y., in 1840. He held various Presbyterian pastorates, and wrote the popular hymns 'Blest Saviour, Thee I Love' (1851); and 'Stand Up, Stand Up for Jesus' (1858).

**Duffield, John Thomas**, American mathematician: b. McConnellsburg, Pa., 19 Feb. 1823; d. Princeton, N. J., 10 April 1901. He was graduated at Princeton in 1841, and at the Theological Seminary there in 1844. At that college he was successively tutor in Greek 1845, adjunct professor of mathematics 1847, and professor of mathematics in 1856, which last post he held for several years. Among his scientific writings are: 'The Discovery of Gravitation'; 'The Philosophy of Mathematics' (1867).

**Duffield, Samuel Augustus Willoughby**, American Presbyterian clergyman and poet: b. Brooklyn, N. Y., 24 Sept. 1843; d. Bloomfield, N. J., 12 May 1887. He was graduated at Yale in 1863, and from 1882 till his death preached at Bloomfield, N. J. Among his writings are: 'English Hymns, Their Authors and History' (1886); 'Latin Hymn-writers and Their Hymns' (1889).

**Duffield, William Ward**, American civil engineer: b. Carlisle, Pa., 19 Nov. 1823. He was graduated at Columbia in 1841 and served as lieutenant on the staff of Gen. Pillow in the Mexican war 1847-8, and during the Civil War commanded the 4th Michigan Infantry. He was breveted major-general in 1863; elected State senator for Michigan in 1878, and appointed chief engineer for railways in Michigan, New York, Illinois, Texas, and United States engineer of improvements on Wabash and White rivers in 1892. His writings include 'School of the Brigade, and Evolutions of the Line'; 'Treatise on Logarithms.'

**Duffy, Sir Charles Gavan**, Australian statesman: b. Monaghan, Ireland, 12 April 1816; d. Nice, France, 9 Feb. 1903. He took to journalism, and in 1842 assisted in founding a Dublin newspaper called the 'Nation.' In 1843 he was convicted of sedition with O'Connell, but the House of Lords in the following year quashed the conviction. He played a prominent part in the founding and directing of the Irish Confederation, and in 1848 he was brought to trial along with other members of that body on a charge of treason-felony, but the prosecution could not obtain a conviction. In 1852 he was elected to Parliament as representative of New Ross, and succeeded in forming an independent Irish political party. Dissensions arose and in consequence he resigned his seat and went to Australia in 1856. For some time he practised as a barrister in Melbourne. In 1857 he became minister of public works in the first responsible Victorian government. In 1858, and again in 1862, he was minister of lands, and became premier of Victoria in 1871. In 1880 he returned to Europe. Several works from his pen have been published, including: 'The Ballad Poetry of Ireland' (1845, about 50 editions); 'Young Ireland: a Fragment of Irish History 1840-50' (1880); 'Four Years of Irish History 1845-9' (1883), a sequel to the preceding work.

**Dufrenoy, dü-frēn-īt**, a native basic phosphate of iron. It occurs in small crystals of orthorhombic form; but usually it is in radiating-fibrous masses, sometimes with botryoidal or drusy surface. Its hardness is 3.5 to 4, and specific gravity about 3.3. It is nearly opaque, has a silky lustre and a blackish-green color. It is found in Westphalia, Bohemia, France, and in Cornwall, England. In the United States it occurs as a fibrous coating in the green sand formation at Allentown, N. J., also in fine radiating masses in Rockbridge County, Virginia. Named in honor of the French mineralogist, Dufrenoy.

**Dufrénoy, Pierre Armand**, pē-ār ār-mān dü-frā-nwā, French geologist and mineralogist: b. Sevrans, Seine-et-Oise, 5 Sept. 1792; d. Paris 20 March 1857. In 1841 he published a great geological map of France with three volumes of text, and this was followed by his 'Treatise on Mineralogy.' He introduced a new classification of minerals, based on crystallography.

**Dufrenoyite, dü-frē-noi'zīt**, an orthorhombic, opaque, brittle mineral of metallic lustre and blackish lead-gray color, named for the French mineralogist Dufrénoy. Hardness, 3; specific gravity, about 5.56. Composition: Sulphur 22.10, arsenic 20.72, lead 57.18 = 100. Found in Switzerland.

**Dufresne, Charles**, shārl dü-frān. See DU CANGE.

**Dufresny, Charles Rivière**, shārl rē-vē-ār dü-frā-nē, French poet: b. Paris 1654; d. there 6 Oct. 1724. He was appointed manager of the royal gardens, on account of the strong love of flowers which he manifested, and in this capacity introduced into France the taste for gardens in the English style. Among his dramatic pieces may be mentioned: 'L'Esprit de Contradiction,' a one-act play in prose; 'Le Mariage fait et rompu,' in verse; and a second prose piece in three acts, called 'Le Double Veuvage.' He also wrote a romance in which he depicts the manners of the time after the fashion of Le Sage, 'Les Amusements sérieux et comiques.'

**Duganne, dü-gān', Augustine Joseph Hickey**, American poet and novelist: b. Boston 1823; d. New York 20 Oct. 1884. He wrote many novelettes and romances, and a great number of miscellaneous papers under various signatures. His principal poetical works are: 'The Iron Harp,' and 'Parnassus in Pillory.' Among his other writings are a 'Comprehensive Summary of General Philosophy' (1845); and 'Class Book of Governments and Civil Society' (New York 1859).

**Dugdale, Sir William**, English antiquary: b. Shustoke, Warwickshire, 12 Sept. 1605; d. there 10 Feb. 1686. He was, in 1640, made *rouge croix poursuivant*, and had apartments in the heralds' office, with ample opportunities for his favorite study. With Dodsworth he prepared the 'Monasticon Anglicanum' (1655-73). The principal work of which Dugdale had the sole merit is the 'Antiquities of Warwickshire' (1656). At the Restoration he was appointed Norroy king-at-arms, and in 1677 Garter king-at-arms, with the honor of knighthood. Besides the works already mentioned, he published the 'Baronage or Peerage of England' (1675-6); 'Origines Judiciales, or Historical Memoirs of the English Law Courts of Justice, etc.' (1666); a 'History of St. Paul's Cathedral' (1658); and various minor writings.

**Dugmore, Arthur Radclyffe**, American artist and author: b. England 25 Dec. 1870. He studied painting at the Belle Arti, Naples; came to the United States in 1889, and has devoted himself to the study of ornithology, drawing, painting, and illustrating by photography. He has published: 'Bird Homes'; 'Habits of the Land Birds Breeding in the Eastern United States' (1900); 'Nature and the Camera' (1902).

**Dugong, dü'gōng, or Duyong**, the Malayan name for the genus *Halicornes* of the order *Sirenia* or 'sea cows.' It is from five to seven feet long, occasional specimens attaining a length of nine feet. It is a marine animal, never ascending rivers, and feeds chiefly on seaweed; in which particular it differs from the related genus *Manatus*. It is found along the shores of Australia, of the Indian Ocean, and around the Red Sea. Unlike the manatee it has a crescent-shaped tail, its nostrils are on the upper part of the muzzle,

## DUGOUT — DUILIUS

and its flippers are quite without trace of nails. The skull of the dugong is characterized by the thickness of the beak and the lower jaw, both of which are bent sharply downward, almost at right angles to the axis of the skull. In the males, the incisors are developed into large, straight tusks, pointing directly downward. In color the animal is grayish-blue sometimes whitish below. The female is proverbial among the Malays for her maternal solicitude for her offspring, of which but one is produced at a birth.

The flesh of the dugong is said to be extremely palatable; but its chief value, from a commercial standpoint, is the fine oil yielded by the Australian species (*Halicore australis*). This has been in such demand for medicinal and other purposes, as to have caused a wholesale slaughter amounting almost to the extermination of the species. See SIRENIA for structure.

**Dug'out**, a cave dug in the side of a hill or mountain, used as a dwelling, partly built of logs as seen in some sections of Montana, or as a place of refuge from cyclones and tornadoes. These are frequently to be seen in some of the western States. Also the name of a canoe or boat made from a log of wood, hollowed and shaped for use.

**Duguay-Trouin, René**, rê-nâ dü-gâ-troo-ân, French seaman: b. St. Malo 10 June 1673; d. Paris 27 Sept. 1736. His various successful privateering expeditions attracted the attention of the government before he was 21, and Louis XIV. sent him a sword. He captured great numbers of English and Dutch ships on the coast of Spain and Ireland; in 1696 he took a great part of the outward-bound Dutch fleet under Wassenaar; in 1697 he entered the royal marine as a captain. He signalized himself so much in the Spanish war that the king granted him letters of nobility, in which it was stated that he had captured more than 300 merchant ships and 20 ships of war. By the capture of Rio de Janeiro (1711) he brought the crown more than 25,000,000 francs. Under Louis XV. he rendered important services in the Levant and the Mediterranean.

**Du Guesclin, Bertrand**, bër-trân dü gâ-klân, constable of France: b. Motte-Broon castle, near Rennes, 1320; d. 13 July 1380. Mainly to him must be attributed the expulsion of the English from Normandy, Guienne, and Poitou. He was captured by Chandos at the battle of Auray in 1364, and ransomed for 100,000 francs. While serving in Spain against Peter the Cruel he was made prisoner by the English Black Prince, but was soon liberated. For his services in Spain he was made constable of Castile, count of Trastamare, and Duke of Molinas; and in 1370 he was made constable of France. See Luce, 'Histoire de Bertrand du Guesclin et de son époque' (1876); Stoddard, 'Bertrand Du Guesclin' (1897).

**Duhamel, William**, American physician: b. Maryland 1827; d. Washington, D. C., 15 Aug. 1883. He was graduated at the Maryland University of Medicine 1849; appointed adjunct professor of surgery in the Georgetown Medical College 1852; attended all the occupants of the White House during three presidential terms and was chief physician to the United States prisons in the District of Columbia 10 years.

**Dühring, Eugen Karl**, oi-gân kârl dü'ring, German philosophical writer: b. Berlin 12 Jan. 1833. He studied at the University of Berlin, and practised law for a time; he then became professor of philosophy and political economy at Berlin in 1864, but gave up the position on account of quarrels with the faculty. He has written: 'Der Wert des Lebens' (1865), which did much to introduce the positivism of Comte into Germany; 'Kritische Geschichte der Philosophie' (1869); 'Logik und Wissenschaftstheorie' (1878); 'Die Judenfrage als Rassen-, Sitten-, und Kulturfrage' (1892); also a number of works in political economy, including 'Kapital und Arbeit' (1865); 'Die Verkleinerer Careys' (1867); and 'Kritische Geschichte der Nationalökonomie und des Sozialismus' (1879).

**Duhring, Julia**, American essayist: b. Philadelphia 23 Feb. 1836. She has been an extensive traveler in the United States, Europe, Asia, and Africa; and has published several volumes of critical essays on social life: 'Philosophers and Fools' (1874); 'Gentlefolks and Others'; 'Amor in Society'; 'Mental Life and Culture.'

**Duiker-bok**, dī'kér- or doi'ker-bök, a genus of small antelopes (*Cephalolophus*), native to southern Africa. They are characterized by small, straight horns, generally present in both sexes; and by an upright tuft of hair between the horns. The typical species (*C. grimmi*) is found in bush-covered districts from the Cape of Good Hope to the Zambesi River, and ranges even farther north along the west coast of Africa. It stands about 26 inches high; its ears are long and narrow; its color is yellowish-brown, with a tendency to gray; but the color is decidedly variable. The horns, in this species present only in the male, are from three to five inches long, and rise at a sharp angle to the face. Of the allied species the following are the most important ones: The redbuck of Natal (*C. natalensis*), which differs from *C. grimmi* in that its horns incline backward, and are present in both sexes; and that its color inclines more to the reddish tint. The bluebuck of the jungle (*C. monticola*) is a tiny creature, only 13 inches high at the shoulder, that swarms in the Natal region. It is smaller and lighter in build than a hare; is bluish mouse-color, and has tiny straight horns. It feeds on berries and young shrubs. The zebra-antelope of West Africa (*C. doria*) is distinguished by its coat of rich golden-brown, banded with eight or nine transverse lines across the back and loins. The wood antelopes, also West African, are nearly three feet tall, and are classed in two species, *C. sylvicultor* and *C. jentinki*.

The name "duiker" signifies "ducker" or "diver," in allusion to the animal's rapidity of motion when in the thickets. Consult: Schweinfurth, 'Heart of Africa' (Leipsic 1878); and other books by African explorers and naturalists.

**Duil'ius, Gaius**, Roman general: b. about 300 B.C. He was trained to arms by his father Marcus, and rose to the highest rank as a naval and military officer. He became consul in 260 B.C., defeating the Carthaginians near Mylæ in that year. In honor of this victory, Rome's first success on the sea, a magnificent column (columna rostrata) was erected.

## DUISBURG—DUKE

**Duisburg**, doo'is-boorg, Germany, city, an inland port of Prussia, in the Rhine province, about 13 miles north of Düsseldorf. The town has civic, educational, and other institutions in keeping with its importance. The finest of the churches is the 14th century Saint Salvator, with fine wall-paintings. Duisburg has blast-furnaces, foundries, and other works depending on the iron trade. Its chemical works, cotton-mills, and commerce are extensive. It is an ancient place, early rose to be a free town, and became a member of the Hanseatic league. It possessed a university from 1655 to 1818. The tomb of Mercator, the famous geographer, is here. Pop. (1900) 93,605.

**Dujardin, Félix**, fā-lēks dū-zhār-dān, French naturalist: b. Tours 5 April 1801; d. Rennes 8 April 1860. From 1827 to 1834 he delivered public lectures in Tours upon geometry and chemistry as applied to the arts. During the same period he published several geological works, in one of which he first made known the curious fact that artesian wells bring to the surface seeds and remains of insects, which have been taken from long distances and transported through subterranean passages. In 1833 and 1834 he published descriptions of the flora of the region of the Loire, and of the geology and fossils of Touraine. He then devoted himself to zoological researches, and published observations upon the *rhizopoda*, for which he proposed a new classification. In 1839 he added extended annotations to the 3d volume of De Lamarck's 'History of Invertebrate Animals,' and among his later publications were his researches upon the brain of insects, and upon the instinct of bees. He was a professor at Rennes from 1839.

**Dujardin, Karel**, Dutch artist: b. Amsterdam 1640; d. Venice 20 Nov. 1678. He went to Italy when young, and was a member of the Society of Painters at Rome, among whom he was called BARBA DI BECCO. His works met with general approbation. His landscapes have spirit and harmony, his figures expression, and his color the brilliancy which distinguishes his school. His paintings are rare, and command a high price. He also published 52 landscapes etched with much spirit and ease.

**Duk-Duk**, in New Pommern (formerly New Britain,—the largest island of the Bismarck archipelago in the Pacific Ocean,—is a secret male society for the preservation of ancient observances among the Melanesian natives. The inculcation of respect and order among the youthful members of the community, the subjection of women, and the enforcement of obedience to the chiefs are among its main objects; its mystic ceremonies, masked dances, etc., are picturesque. The society is analogous to the West African negritral Mumbo Jumbo organizations, and is interesting sociologically as an uncivilized form of the *Vehmgericht*, lodges, bachelors' clubs, etc., of Europe and America. Consult: Powell, 'Three Years Among the Cannibals of New Britain' (1897).

**Duke** (in French *duc*, in Spanish *duque*, in Italian *duca*, in Venetian *doge*, all derived from the Latin *dux*, leader, commander), a title belonging originally to a military leader. The title seems to have come into use when Constantine separated the military and civil commands of the provinces; the title *dux* was then applied

to the military governor of a province, and the ducal rank was made inferior to that of the *comes* (count). The Goths, Franks, and other northern tribes who invaded the vast Roman territories, adopted, if they had not before borrowed, the titles of duke and count. Among those warlike peoples, however, the dukes, as military chiefs, soon acquired a marked pre-eminence over the counts, whose functions in the eastern and western empires were more of a civil and judicial nature. Under Charlemagne, who was jealous of the increasing power of the higher nobility, the dignity was suffered to cease, but under his weaker successors the ducal governors of the provinces attained an almost absolute independence. The concession of hereditary power and independent jurisdiction, first to the central province known as the Isle de France, and then to Aquitaine, extended itself under the Carolingians to Burgundy, Normandy, and Gascony, and on the accession of Hugh Capet to all the other subaltern tenures. It was not long until the dukes, feeling secure in the unlimited governing power of their provinces, proclaimed their title to be as good as that of the king. They coined money, assumed the crown and sceptre, gave law to their subjects, made war even against the king, and reduced the royal jurisdiction to a few towns such as Rheims and Laon. From the time of Philip II. (Philippe Auguste) to that of Louis XI., however, these duchies were gradually reunited to the crown, and those subsequently accorded to the members of the royal family enjoyed none of the privileges of independent sovereignty. Prior to the Revolution dukes were created by letters patent of the king, and were of three kinds, and those designated as dukes and peers held the first rank and had a seat in parliament. The dignity of the second class descended to their male children, but that of the dukes by brevet ceased with themselves. The rank of Duke in the royal family of France was superior to that of prince, and sometimes inferior to that of count. The ducal, along with all other titles of nobility, was abolished at the Revolution, but was restored by Napoleon in 1806. In Germany the dukedom passed through phases similar to that exhibited in France. In 847 the Emperor Louis appointed a duke (Herzog) of Thuringia to protect the frontiers against the Wendes, or Vandals, a Slavonic tribe. The power of the dukes gradually increased, their dignity became hereditary, and they soon became powerful members of the German empire. An archbishop of Cologne, Bruno, was the first who bore (in 959) the title of archduke (Erzherzog), which since the time of the Emperor Frederick III. (1453) has been given exclusively to the princes of the house of Austria. All the Austrian princes are archdukes, as a distinguishing title of the imperial family. In Great Britain the title of Duke ranks as a title of honor or nobility next below that of a prince or princess of the royal blood and that of archbishop of the Church of England. The first hereditary Duke in England was the Black Prince, created by his father, Edward III., in 1336. The duchy of Cornwall was bestowed upon him, and was thenceforward attached to the eldest son of the king, who is considered a Duke by birth. The duchy of Lancaster was soon after conferred on his third son, John of Gaunt, and hence arose the special privileges which these two duchies still in part retain. In the reign of Elizabeth, in 1572, the



## DUKE OF CONNAUGHT—DULCIMER

ducal order was extinct, and not revived till the creation of Villiers, Duke of Buckingham, and Ludovic Stuart, Duke of Richmond, by James I. There are over 30 dukes on the British peerage rolls, including those of the blood-royal. The coronet of a British Duke consists of eight strawberry leaves of a conventional type on a rim of gold. In the Bible the word *dukes* is used, Gen. xxxvi. 15, for the *duces*, of the Vulgate.

**Duke of Connaught**, kōn'nōt, ARTHUR WILLIAM PATRICK ALBERT, Prince of the United Kingdom, Duke of Saxony, Prince of Coburg and Gotha. He was born at Buckingham Palace, 1 May 1850, being the third son of Queen Victoria. He entered the Military Academy at Woolwich 1866; was rapidly promoted, and received his commission as general of brigade in 1880. He had been created Duke of Connaught and Stratheam and earl of Sussex 26 May 1874, and taken his seat in the House of Lords 8 June of the same year. He married Princess Louise Margaret of Prussia, the grand-niece of the Emperor William of Germany, 13 March 1879.

**Duke of Exeter's Daughter**, a rack in the Tower of London, so called after its inventor, a minister of Henry VI. According to Blackstone it was never put in use.

**Duke's Children**, *The*, the last of the political novels by Anthony Trollope, published in 1880.

**Duke's Laws**, so named from the Duke of York, afterward James II., was a code promulgated by Col. Richard Nicolls, the English commander who took New Amsterdam from the Dutch in 1664, and became governor of the colonies under the Duke's patent. They applied first to the Dutch: confirmed the patroons in their estates, which thenceforth were to be called manors; introduced jury trial; amended the criminal code, and provided for freedom of religion and equal taxation, and militia service. There was no popular election of magistrates at first; but the code was afterward modified into the instrument of government of New York and New Jersey.

**Dukhobors**, doo-kō'bōr, **Dukhobort'sy**. See DOUKHOBORS.

**Duk'infield**, England, a borough in county of Chester, a few miles from Manchester. Extensive collieries, cotton factories, engineering, brick and tile works give employment to the greater part of the population. Pop. (1901) 18,929.

**Dulag**, doo'lāg, Philippines, a town on the eastern coast of the island of Leyte, at the mouth of the Catbassag River. There are large deposits of sulphur in the vicinity. Pop. 10,113.

**Dulangan**, doo-lān'gān, or **Gulangan**, a heathen tribe of the Philippines, living in the southern part of the province of Davao, island of Mindanao. It is uncertain whether they are of pure Malayan race, or have an infusion of Negrito blood.

**Dula'ny**, Daniel, American colonial lawyer: b. Annapolis, Md., 1721; d. 1797. He was educated in England, at Eton, Cambridge, and the Temple, and was admitted to the bar of Maryland in 1747. He was deputy commissary general from 1754 to 1761, and a member of

the provincial council from 1757 to 1775. In 1765 he wrote a powerful pamphlet against the Stamp Act, and his arguments against arbitrary taxation furnished material for Chatham's famous speech on behalf of the American colonies in 1766. He was, however, a staunch Royalist, refused to take part in the Revolution, and lost nearly all his landed property by confiscation.

**Dulcama'ra**, a species of the genus *solanum* of the potato family (*Solanaceæ*), known also as night-shade, blue bindweed, felonwort, poison flower, and bitter-sweet. See BITTER-SWEET.

**Dulcama'rin**, a glucoside which is separated from the aqueous extract of *Solanum Dulcamara*—bitter-sweet, and consists of a yellow, transparent, resinous, easily powdered mass, readily soluble in alcohol, sparingly in ether, and very slightly in water. It has a slight alkaline reaction, and yields a platinum salt. The narcotic alkaloid solanine is also obtained from bitter-sweet.

**Dulce**, dool'sā. (1) A lake of Guatemala, on the east coast, communicating with the Gulf of Honduras by the lakelet el Golfete. It is about 30 miles long by 12 broad. (2) A river in Argentina, has its rise in the province of Tucuman, and is called in its lower course the Saladillo River. The waters are salt for some distance from the mouth; and the stream really seems to lose itself in the salt marshes of Lake Porongos. (3) A gulf on the coast of Costa Rica, in Central America.

**Dul'ce Do'mum**, a famous song sung at Winchester College, England, on the eve of the break-up day for the summer holidays. The origin of both words and music is very uncertain—it is usual to ascribe the former to one Turner, probably him who became bishop of Ely, and was one of the seven bishops under James II.; the latter, to Johannes Reading, organist of the college from 1681 to 1689.

**Dulcigno**, dool-chēn'yō, Montenegro, a small seaport town on the Adriatic. The inhabitants, formerly notorious under the name of *Dulcignottes*, as the most dangerous pirates of the Adriatic, are now engaged in commerce or in the fisheries of the river Bojana. Pop. 5,102.

**Dul'cimer**, an ancient musical instrument used by various nations, and, in shape and construction, having probably undergone fewer changes than any other instrument. In its earliest and simplest form, it consisted of a flat piece of wood, on which were fastened two converging strips of wood, across which strings were stretched tuned to the natural scale. The only improvements since made on this type are the addition of a series of pegs, or pins, to regulate the tension of the strings, and the use of two flat pieces of wood formed into a resonance-box, for the body. The German name, *Hackbrett* (chopping-board), points to the manner in which it was played, the wires being struck by two hammers, one held in each hand of the performer. The fact which makes the dulcimer of the greatest interest to musicians is that it is the undoubted forefather of our pianoforte. A modern grand pianoforte is, in reality, nothing more than a huge dulcimer, the wires of which are set in vibration, not by



## DULCINEA DEL TOBOSO—DULUTH

hammers held in the pianist's hands, but by keys; it is, in fact, a keyed dulcimer. It is by some supposed to be identical with the psaltery or *nebel* of the Hebrews.

**Dulcinea Del Toboso**, *dül-sin'ē-ä dël tō bö'sō*, Sp. *dool-thē-nā'ä däl tō-bō'sō*, the fanciful name given by Don Quixote to his lady love, because it was more romantic than her real name, Aldonza. The name is a popular one for the heroine of love romances.

**Dul'cinist**, one of a sect, followers of Dulcinus, or Dolcino, a layman of Lombardy in the 14th century. See APOSTOLIC BRETHERN.

**Dulcite** ( $C_6H_8O_6$ ), a saccharine substance obtained by Laurent in 1850 from an unknown sugary plant from Madagascar, which was in rounded lumps, but crystalline when broken through. By dissolving in water, filtering from impurities, and evaporating, the dulcite was deposited in large transparent, lustrous, modified monoclinic prisms. Dulcite has a specific gravity of 1.46. It has a slightly sweet taste, no odor, and no rotatory effect on light. It is soluble in water, very sparingly soluble in alcohol. It fuses about  $360^{\circ} F.$ ; at a higher temperature it loses water and yields *dulcitan*, and at still higher temperature is decomposed, giving off gases and a distillate with an acetous odor. It does not ferment with yeast. Dulcite combines with metallic oxides; the compounds with the alkalies and alkaline earths are crystalline and soluble in water.

**Du Lhut**, *dü-loot*, **Daniel Greysolon**, American pioneer: b. France about 1645; d. near Lake Superior 1709. He went to Canada about 1670, and became a trader and a leader of bushrangers. He chose the sites of Detroit and Fort William, fought in the Canadian war with the Senecas in 1687, and against the Iroquois in 1689, and was commander of Fort Frontenac in 1695. The city of Duluth is named after him.

**Duluth**, Minn., city and county-seat of St. Louis County, at the western end of Lake Superior, 1,463 miles from New York, 478 miles from Chicago, 400 miles from Milwaukee; and northeast 522 miles from Omaha, 2,370 miles from San Francisco; and southeast from Seattle 1,919 miles, and 498 miles from Winnipeg. Its area is 69 square miles and it extends along Lake Superior, Duluth harbor, and the St. Louis River from Lakeside to Fond du Lac, a distance of 24 miles. Duluth began at the base of Minnesota Point and has spread east and west along the water line, as well as northward upon the face of the great bluff, which, in the course of a mile from the water's edge, rises to a maximum height of 800 feet. Of its 200 miles of streets, 54.48 were in 1903 paved with various materials or macadamized, while a great deal of new paving work was being done.

**Government.**—The mayor, treasurer, comptroller, and two aldermen from each ward are elected by the people for two years; the clerk is appointed by the council. The chief of police, city engineer, city attorney, assessor, the city boards and minor officers are appointed by the mayor.

**Municipal Improvements.**—Street cleaning is a comparatively easy task, the greater part of the city enjoying the benefit of natural drain-

age. Street cleaning costs \$14,814.20 a year, and street sprinkling, \$7,779.74, is assessed to property. The sewage empties, through 40 miles of mains, into Lake Superior and Duluth harbor. Climate, clean streets, and pure water make Duluth one of the healthiest cities in the world, the death rate in 1900 being 13.2.

The city owns the water and gas systems. Water is drawn from a point 10 miles down the north shore of the lake, which is never approached by sewage. The city also owns the gas plant and during its ownership has reduced the price of gas from \$1.90 to 90 cents per 1,000. While thus reducing the price of water and gas, the city has spent a great deal of money on depreciated plants. The total cost of these plants to the city is: Water, \$2,081,072; gas, \$429,860. The police department costs \$49,401, and the fire department, \$101,933.23 per annum.

The electric street railway system consists of about 50 miles of track, representing an investment of \$2,500,000. The Duluth-Superior Traction Company controls the street railway system of both Duluth (Minn.) and Superior (Wis.). The line passes over the great interstate bridge and covers the time between the two cities in 35 minutes. In 1902 there were carried on the street railway system 8,000,000 passengers, and \$285,000 was expended in operating expenses.

**Public Parks and Cemeteries.**—The Duluth park system consists of five larger parks, two smaller ones, and five city squares. Fairmont Park at West Duluth contains 40 acres; Lincoln, at the West End, 50; Central, Central Duluth, 100 acres; Chester Park, East End, 100 acres; Lester Park, extreme East End, 25 acres; Cascade Park, 6th Street and First Avenue west, whose beauties are indicated by its name, covers 4 acres. Portland Square covers a block at West 4th Street and Tenth Avenue east. The main feature of this park system is Rogers boulevard, and the parks Fairmont, Lincoln, Central, Chester, and Lester. The boulevard is a drive of 7 miles along the bluffs at a height of 500 feet above Lake Superior, which is itself 600 feet above the level of the sea. From this drive is visible one of the finest views in the world. The chief beauties of Duluth's parks lie in the natural loveliness of forests, streams, rocks, and cascades. There are five cemeteries: Calvary Hill, Forest Hill, Oneota, Park Hill, Scandinavian Union, and Swedish Mission.

**Chief Buildings.**—Among the chief buildings the Central High School is probably the most extraordinary. It stands on a site more than 200 feet above the lake, site and building occupying a whole block. It has four stories, with commodious attic and basement, and a tower 229 feet high. Other prominent buildings are the Carnegie library, the State Normal School, the Spalding and St. Louis hotels, the Lyceum Theatre, the new buildings in the wholesale district, of which the Marshall-Wells is the largest wholesale hardware building under one roof in the world; the Wolvin building, and the huge elevators and flouring mills; the Board of Trade, and Federal buildings. The Duluth Public Library building was the donation of Andrew Carnegie. The fund was \$75,000. The building and grounds represent an outlay of \$93,000. The library now contains 40,000 volumes.

## DULUTH

Among churches are the Cathedral, and 7 other Catholic churches, 6 Episcopal, 6 Baptist, 1 Christian Science, 2 Congregational, 1 Swedish Covenant, 3 Evangelical, 17 Lutheran, 11 Methodist Episcopal, 1 Unitarian, 1 Salvation Army Corps, and 2 Hebrew synagogues.

*Educational and Intellectual Associations.*—The city had in 1903 1 high school, 31 elementary and kindergarten schools, with 32 school buildings, an average daily attendance of 8,791 pupils and 258 teachers; 3 Roman Catholic parochial schools, and an Institute of the Sacred Heart. The new State Normal School had 100 pupils at the opening in 1903. The hospitals have a training school for nurses. The value of public property used for school purposes was in 1903 \$1,869,700 and the total expenditure for public schools for the school year 1903-4 was \$309,773.76. In 1903 Duluth had 2 daily papers, 6 weeklies, and a bi-weekly.

*Manufactures.*—The manufactures of Duluth, according to the census of 1900, were: Establishments, 433; capital, \$8,872,940; employees, 3,998; wages paid, \$2,145,444; cost of materials, \$5,861,499; total value of product, \$10,628,957; lumber and timber product, \$3,800,000; planing mill product, \$172,943; foundry and machine, \$475,848. In 1903 the Great Northern Power Company had acquired practically all the water power available at the head of Lake Superior. This water comes down through a vast drainage through the rapids of the St. Louis River to a point within the city of Duluth. These rapids aggregate a fall of nearly 600 feet. The company divided this power into two systems; the St. Louis Development, under a head of 365 feet, and the Duluth Heights System, under a head of 740 feet. For the first installation on the St. Louis rapids, the company had in 1903 a full-developed plan to build a steel dam 36 feet high and 628 feet across the river at the head of the rapids, thus creating a reservoir or forebay, about one mile square in extent, whence a canal 62 feet in width at the surface and 14 feet deep was to carry the water  $2\frac{1}{2}$  miles to the brow of a hill, and thence by a series of wood stave and steel pipes to the main power house at the foot of the rapids under an effective head of 365 feet. The company aims at an ultimate development of 100,000 electric horsepower. This power is to be transmitted not only to Duluth but to Superior, the iron ranges and to other towns a long distance away.

The Duluth Heights System has a capacity of 200,000 horsepower additional, which is to be developed later on under an effective head, estimated at 740 feet, from the bluff directly back of the city of Duluth. The possibilities of the St. Louis water power have been appreciated for many years and engineers have been working on the problem of harnessing it to do man's work for a quarter of a century. The cities of Duluth and Superior voted liberal franchises to the company in 1902 and 1903, and in the latter year were looking forward confidently to developments which would revolutionize manufacturing at the head of Lake Superior. The Zenith Furnace Company, capitalized at \$950,000 in 1903, equipped a modern blast furnace at West Duluth with a daily capacity of 250 tons of pig iron. The company in the same year established a coking by-product plant. The company at the same date entered

into a contract with the city of Duluth to supply the latter with gas.

*Trade and Commerce.*—As the western terminus of the marine traffic of the Great Lakes, Duluth holds an important place in world-commerce. For 1902 the aggregate of vessel arrivals and departures at this port was 9,659. The arrivals numbered 4,816 and the departures 4,843. The registered net tonnage of arrivals and departures aggregated 13,927,284 net tons. In 1902 the total receipts of freight at the port of Duluth were 1,291,357 net tons, of a valuation of \$31,431,750, and the shipments were 7,884,236 net tons of a valuation of \$65,080,803. The total of freight received and shipped was 9,175,593 tons and the valuation of the same was \$96,512,553. The shipments of iron ore from Duluth for 1902 were 5,598,408 gross tons, as compared with 3,437,955 gross tons in 1901. Two Harbors, which holds the world's season record for the amount of iron ore forwarded from a single shipping point, is a sub-port of Duluth. Its record in 1902 was 5,605,185 gross tons as against 5,018,197 gross tons in 1901.

Duluth leads all other ports on the Great Lakes in point of vessel tonnage enrolled. It is the port of hail for 331 vessels, having an aggregate gross tonnage of 493,620, as shown by figures in the port collector's office, June 1903. Eleven lines ply regularly in the steamboat merchandise trade of Duluth, carrying both passengers and freight. Of the great number of coarse, bulk cargo lines, the Pittsburg Steamship Company, with 112 boats, controlled by the United States Steel Company, is the first.

The grain elevator storage capacity of Duluth is 17,000,000 bushels. There are two systems, the Consolidated Elevator Company, owning eight houses and having a total capacity of 12,000,000 bushels, and the Peavey system, with a total capacity of 5,000,000 bushels. The latter has the largest concrete elevator in the world and the only one of the kind in the United States. Its capacity is 4,000,000 bushels, and that of the working-house 1,000,000 bushels. For the crop year ending 31 July 1903 the total receipts of grain at Duluth were 26,296,921 bushels, of which the Consolidated received 17,900,000 and the Peavey 8,396,921 bushels.

The lumber shipments from this port for 1902 amounted to 279,787,788 feet. There are five coal docks, with an average storage capacity of about 1,000,000 tons. The receipts for 1902 were 818,532 tons of bituminous and 87,383 of anthracite.

The striking natural feature of the Duluth-Superior harbor is the great breakwater formed during countless ages by the contending waters of Lake Superior and of the St. Louis and Nemadji rivers descending from the heights. The seven miles of this breakwater to the northward is called Minnesota Point. The two miles at the south, from the natural entry to the Wisconsin mainland, is called Wisconsin Point. The Duluth Canal cuts this point about half a mile from the main land, and was originally the work of the people of Duluth, although the United States government subsequently took charge of it; and some years ago undertook the widening of it. It is 300 feet wide and 1,700 feet long and 25 feet deep, running between cement piers 10 feet high, which were completed in 1901 at a cost of \$550,000.

## DUMANJUG—DUMAS

Duluth has eight railroads: Great Northern, Northern Pacific, Chicago, Milwaukee & St. Paul; Wisconsin Central; Chicago, St. Paul, Minneapolis & Omaha; Duluth & Iron Range; Duluth, Missabe & Northern, and the Duluth, South Shore & Atlantic.

Headquarters of six of the large constituent companies of the United States Steel Corporation are located in Duluth. They are engaged in the mining of ore on the Missabe and Vermilion ranges north of this city; in the carrying of it over railroads to the shore of Lake Superior, and in the transportation of it from docks here and in Two Harbors to the corporation's smelters and rolling mills in eastern States. The iron output of the ranges is practically controlled by the United States Steel through these constituent companies. The six are: The Minnesota Iron Company, Chandler Iron Company, and Oliver Mining Company, including over a score of mining firms in the combination of the trio; the Duluth, Missabe & Northern Railroad Company, the Duluth & Iron Range Railroad Company, and the Pittsburgh Steamship Company.

The most extraordinary feature of Duluth's commerce during recent years is the growth of her wholesale trade, particularly in the line of hardware and groceries, which has spread to the Pacific coast and even to Alaska.

*History.*—Groselliers, a French fur trader, and his associates were the first white men who visited what is now Duluth. In 1660 they shipped from the head of Lake Superior 60 canoes laden with furs. Daniel Greysolon Du Luth, after whom Duluth was named, was a French officer, who urged by an adventurous spirit led a strong party to the westward, following the line of the Great Lakes. He traded with the Indians at Fond du Lac in 1679, and it has been believed that he at one time maintained a camp on Minnesota Point. It was not until 1854 that the Indian title to the territory on which this city is built was extinguished by treaty. An election for the Territory of Minnesota, the object of it being to choose a delegate to Congress, was held on the unorganized, unplatted town-site of Duluth in October 1855. In May 1857, Duluth was incorporated as a town by an act of the territorial legislature. In 1867 a railroad from Duluth to St. Paul was begun and in 1870 the St. Paul & Duluth, the first railroad, was completed. In the same year Duluth was organized as a city; but the Jay Cooke failure of 1872 was a blow to the new mart of commerce and she relapsed into a village, retaining that status until 1890. Real work for the development of the iron ranges began in 1878, and in 1882 the first iron range railroad was completed between Two Harbors and Vermilion Lake. The hand of panic fell hard on Duluth in 1893 and depression lasted until 1899, since which time the city has enjoyed an exceptional share of prosperity.

*Population.*—The population of Duluth was 3,470 in 1880; 33,187 in 1890; and 52,969 in 1900. At the last date the foreign-born population was 39.6 of the total, the leading nationalities being as follows: Canadian English, 5,099; Swedish, 5,047; Norwegian, 2,655; German, 1,685; Canadian French, 1,285; Polish, 920; English, 817; Irish, 792; Finnish, 702; Italian, 202.

A. M. FLAGG,

Editor Duluth News Tribune.

**Dumanjug**, doo-män-hoog', Philippines, a town of the province of Cebu, situated on the west coast at the mouth of the Dumanjug River, 37 miles southwest of Cebu. It is open to the coast trade, and is a military station. Pop. 13,171.

**Dumas**, dü-mä, **Alexandre**, the Elder, French dramatist and novelist: b. Villers-Cotterets 24 July 1803; d. Puits, near Dieppe, 5 Dec. 1870. He was the son of a Republican general who bore the same name, and grandson of Marquis de la Paillette and a negress, Tiennette Dumas. He went to Paris at the age of 20, to push his fortune, and was employed by the Duke of Orleans as secretary at 1,200 francs a year. He now devoted his leisure hours to completing his education, and his ambition prompted him to shine in the field of literature. Some of his lighter dramatic works were rejected by the theatrical directors, some were accepted, and had more or less success, bringing but little fame or profit to their author. At last, in 1829, his drama of 'Henri III.' appeared on the stage of the Comédie Française. It was produced when the battle between the Romanticists and the Classicists was at its height, and hailed as a triumph by the former school. The piece became popular and brought the lucky dramatist the sum of 30,000 francs, and the post of librarian to the Duke of Orleans. The same year appeared his 'Christine,' and in quick succession, 'Anthony'; 'Richard d'Arlington'; 'Térésa'; 'Le Tour de Nesle'; 'Catharine Howard'; 'Mlle. de Belle-Isle,' etc. Dumas had now become a noted Parisian character. The critics fought over the merits of his pieces, and the scandalmongers over his prodigality and *galanteries*. Turning his attention to romance, and desirous of becoming the Walter Scott of his country, he produced a series of historical romances, among which are: 'Les Deux Dianas'; 'La Reine Margot'; 'Les trois Mousquetaires,' which, with its continuations, occupies eight volumes. The 'Comte de Monte-Cristo,' and the 'Mémoires d'un Médecin,' are also well known through translations to English and American readers. Several historical works also bear his name: 'Louis XIV. et son Siècle'; 'Le Regent et Louis XV.'; 'Le Drame de '93'; 'Florence et les Médecins,' etc. In 1846 he accompanied the Duke of Montpensier to Spain as the historiographer of his marriage; and on his return to Paris he opened a theatre for the purpose of producing only his own pieces; and built a fantastic and costly country-seat, which was known as the Château de Monte-Cristo, and on which he expended 450,000 francs.

It is difficult to come to a satisfactory conclusion as to the merits of this author. Some of his productions are little else than mere translations from English and German sources. His first drama, 'Henri III.' is but a skillful piece of patchwork, Walter Scott and Schiller furnishing him with the bulk of the material. Equally fatal to his reputation is our knowledge of the fact, gained from a lawsuit he had with the *Presse* and the *Constitutionnel* newspapers, and from a work by Mirecourt, entitled, 'Fabrique de Romans, Maison A. Dumas et Cie.' (Dumas & Company's Romance Factory), that he had arranged to supply those journals during the year with more novels than the most expert scribe could copy in the time, and

that he had in his pay numerous hacks who did the serious part of the work. The only claim he could lay to a great number of the productions issued under his name, was that he either sketched the plot or revised them before going to press. Yet of the talent and even genius of Dumas there can be no reasonable doubt; he had great fertility of invention, much humor and gaiety, and genuine dramatic power, as the works that were undoubtedly from his pen sufficiently testify; and it was not till he had secured a front rank in literature by his own exertions that he descended to the unworthy plan of employing assistants to manufacture novels to order. See Blaze de Bury, 'Alexandre Dumas, sa vie, son temps, son œuvre' (1885); Wells, 'Century of French Fiction' (1898); Parigot, 'Le drame d'Alexandre Dumas' (1898); and 'Alexandre Dumas père' (1902); Spurr, 'Life and Writings of Alexandre Dumas' (1902).

**Dumas, Alexandre**, the Younger, French dramatist and novelist: b. Paris 28 July 1824; d. there 27 Nov. 1895. He was the natural son of Dumas the Elder (q.v.), and while a young man shared his father's life in Paris, and accompanied him on his travels. In 1847 there appeared a collection of his poems under the title 'Péchés de Jeunesse'; his first novel 'Aventures de Quatre Femmes et d'un Perroquet,' was published in the same year; others of his novels are 'Césarine' (1848); 'La Dame aux Camélias' (1848); 'Le Docteur Servan' (1849); and 'L'affaire Clemenceau' (1866). 'La Dame aux Camélias' was dramatized in 1852, and marked the introduction of realism in the treating of social and moral problems on the stage. His other dramas include: 'Diane de Lys' (1853); 'Le Demi Monde' (1855); 'La Question d'Argent' (1857); 'Le Fils Naturel' (1858); 'Un Père Prodigue' (1859); 'L'Ami des Femmes' (1864); 'La Femme de Claude' (1873); 'La Princesse de Bagdad' (1881); 'Denise' (1885); and 'Francillon' (1887). He has also written a few essays, discussing social problems; these are: 'Lettre sur les Choses du Jour' (1871); 'L'Homme-Femme' (1872); 'Question du Divorce' (1880); 'Recherche de la Paternité' (1883). Dumas was made a member of the French Academy in 1874.

**Dumas, Jean Baptiste André**, zhôn bāp-tēst ān-drā, French chemist: b. Alais, Gard, 14 July 1800; d. Cannes, France, 11 April 1884. He studied at Geneva, and going to Paris in 1821, was first a lecturer in the École Polytechnique, then professor of chemistry in the Athénée, the École Centrale des Arts et Manufactures (founded by himself), and finally, the Sorbonne. He now wholly devoted himself to chemical studies; and his views on chemical equivalents, and especially his memoir on the atomic theory, soon attracted attention over all Europe. His views on the laws of substitutions involved him in a long discussion with the great Berzelius. His researches in organic chemistry, especially his masterly papers on the ethers, ethereal oils, indigo, and the alkaloids, placed him in the first rank of chemists. In 1849-51 he was minister of agriculture and commerce, and also held offices under the Second Empire. In 1875 he was called to fill Guizot's chair in the Academy. His chief works are: 'Traité de Chimie appliquée aux Arts,' and 'Leçons sur

la Philosophie Chimique.' See Maindron, 'L'Œuvre de J. B. Dumas' (1886).

**Dumas, Matthieu**, French soldier and military writer: b. Montpellier, France, 23 Dec. 1753; d. Paris 16 Oct. 1837. He early entered the French cavalry, took part in the American Revolution, and was employed in the Levant and in Holland. At the commencement of the French Revolution he assisted Lafayette in organizing the National Guard. On the triumph of the extreme party in 1797 Dumas was proscribed, but made his escape to Holstein, where he wrote the first part of his 'Précis des Événements Militaires,' a valuable source for the history of the period of which it treats (1798-1807). After the Restoration, Louis XVIII. appointed him councilor of state and gave him several important appointments connected with the army. In 1830 he aided in bringing on the revolution of July, and after the fall of Charles X. obtained the chief command of all the national guards of France, together with a peerage.

**Du Maurier, dü mō-rē-a, George Louis Palmella Busson**, English artist, caricaturist, and novelist: b. Paris 6 March 1834; d. London 8 Oct. 1896. He belonged to an old French family which had been driven to England by the Revolution, and was a naturalized British subject. He spent some years in France and Belgium, and afterward went to school in London. He soon adopted art as a profession, working as a student in the galleries of the British Museum. Then, returning to Paris, he entered the studio of Gleyre, and next went to Antwerp to continue his artistic training. Returning to London, he began to draw on wood for 'Once a Week,' the 'Cornhill Magazine,' etc., and also exhibited at the Royal Academy. He subsequently joined the 'Punch' staff and became famous through his weekly drawings for that publication. He also illustrated a large number of books, including Thackeray's 'Esmond' and 'Ballads.' A collection of his 'Punch' woodcuts was published in 1880 under the title 'English Society at Home.' In 1891 appeared his first novel, 'Peter Ibbetson,' and in 1894 'Trilby,' a story which had a great popularity both in book form and on the stage. An incomplete novel by him was published posthumously as 'The Martian.' His novels can hardly be looked upon as very serious contributions to literature, but his 'Punch' drawings will no doubt have a permanent value as portraying many of the peculiarities of contemporary society.

**Dumb Ague**, an irregular intermittent fever, so named from the absence of shivering chills. See MALARIA.

**Dumb-bell.** See GYMNASTICS.

**Dumb-cane**, a popular name for a West Indian plant (*Dieffenbachia sequina*) of the arum family. The acidity which is characteristic of most of the members of the arum family in this species causes a swelling of the tongue with excruciating pain, if the plant is chewed, and for a time destroys the power of speech, whence its name. Many species and varieties of *Dieffenbachia* are in cultivation as foliage plants.

**Dumbar'ton** (ancient LENNOX or LEVENIX), (1) A maritime county of Scotland. Pop. (1901) 113,870. (2) A seaport, and the chief town in the

## DUMBNESS — DUMONT

county, on the Leven; 13 miles northwest of Glasgow. Ship-building is the chief business, the six principal yards employing about 4,000 men. The rock and castle of Dumbarton, a short distance from the town, is noted in history. The fortress was erected over a thousand years ago. It is one of the four fortresses stipulated to be kept in repair by the articles of the Union. Pop. (1901) 19,864.

**Dumbness**, inability to speak. In a very large number of cases it arises from no malformation of the organs of speech, but is a necessary sequence of congenital deafness. A child acquires language by listening to and imitating the speech of its relatives or other people who talk in its presence, and picks up not merely the language of its country, but the exact pronunciation of the locality in which it for the time is. Total deafness, therefore, naturally produces dumbness. Distinct from congenital dumbness is the loss of speech in the case of those who have become affected with aphasia, which results from some disease of the brain, and aphonia, which is due to disease of the larynx or vocal chords. See DEAF-MUTES.

**Dum'dum**, India, town, municipality, and cantonment in the province of Bengal, five miles east-northeast of Calcutta. The town is famous as being the scene of the first open manifestation of the Sepoys against the greased cartridges, which led to the outbreak of the mutiny of 1857. Pop. (1891, including the military), 21,000.

**Dumdum Bullet**, a bullet so named after Dumdum Arsenal, the place near Calcutta where it was first made. It is one which instead of having its greatest strength at the point is weakest there, so that in striking a bone it will flatten out and shatter it, and not, like the modern steel-coated, sharp-pointed bullet, make a small hole and pass through without any other effect. At Santiago the Spaniards were charged with cutting off the brass tips of their bullets so that they had the same effect in inflicting jagged wounds as the regular dumdum bullets. Dumdum bullets are now used to some extent by big game hunters. The Hague Peace Congress agreed that dumdum bullets should not be used in war. In the war against the Boers in South Africa (1899-1902) the British were charged with using a modification of this bullet. See BULLET.

**Duméril, André Marie Constant**, än-drä mä-rê kôn stän dü-mä-rêl, French physician and naturalist: b. Amiens 1 Jan. 1774; d. Paris 2 Aug. 1860. From 1801 to 1818 he was professor of anatomy and of physiology of the medical faculty of Paris. His works on natural history and analytical zoology are distinguished both for accuracy of details and for philosophical treatment. In his most celebrated production, 'L'erpétologie générale' (1835-51), which contains the first attempt at a systematic description of all known reptiles, he had Bibron as collaborator.

**Dumersan, dü-mär-sän, Théophile Marion**, French playwright: b. Issoudun 4 Jan. 1780; d. Paris 13 April 1849. He was employed in the Paris mint. He wrote many plays, all marked by keen observation and comic spirit. His 'Angel and Devil,' a five-act drama, had a "run" of over 100 presentations; still more successful

was his 'Mountebanks,' his masterpiece and a classic in its kind. Other very successful plays written by him are: 'The Wigmaker, or Heads à la Titus'; 'Ridiculous Englishwomen.' Worthy of mention is his volume of 'National and Popular Songs of France.'

**Dumfries, düm-frêz'**, a maritime county, Scotland; area 1,098 square miles. The surface is irregular; about one half is good farming land, and valuable minerals are found in the hill sections.

**Dumfries**, a river port, railroad centre and parliamentary borough, capital of the county of same name, and the chief town in the south of Scotland; on the Nith, about six miles from its junction with the Solway Firth. It is connected with the suburb Maxwelltown (in Kirkcudbright) by three bridges, one dating from the 13th century. Pop. (1901) 72,569.

**Dummer, Jeremiah**, American scholar: b. Boston about 1680; d. in Plaistow, England, 19 May 1739. He was graduated at Harvard College in 1699, where he was noted for the vigor and brilliancy of his genius. With the purpose of preparing for the clerical profession, he went abroad, and studied in the university of Utrecht. On his return to America he abandoned his chosen vocation, and soon after went to England, where, as agent of Massachusetts, he rendered important services to his countrymen. He was an admirer of Lord Bolingbroke, in whose daring and reckless genius he found much that was congenial to his own character, and in intimacy with whom he adopted something of his moral and religious license. He published theological and philosophical disquisitions in Latin while at Utrecht, and his 'Defence of the New England Charters,' written in England (1728), is admirable both in style and matter. The traditions and records concerning him alike testify to his remarkable powers, and his easy command of them in speaking, writing, and in intercourse with men.

**Dummer's War, 1724-5**, an episode in the long struggle of the French governors of Canada to check English settlement by inciting the Indians to raids and massacre of the border settlers. It was named after William Dummer, acting-governor of Massachusetts, who organized the resistance against the Indian expeditions sent by Vandreuil, governor of Canada, against the villages of Massachusetts and Maine, and of Vermont where Fort Dummer had been built on the site of Brattleboro in 1724. One of its chief incidents was the aggressive retaliation of Dummer and the victorious assault by the English on Norridgewock, Me., when Sebastian Rale, the Jesuit missionary and Indian leader, was killed with 26 Abenaki Indians, 12 Aug. 1724. The further crushing decimation in Lovewell's fight (q.v.) at Fryeburg, Me., 8 May 1725, led to four Indian chiefs signing a treaty for the Penobscots and other Abenakis at Boston in November 1725, which was ratified by the latter the following year.

**Du Mond', Frank Vincent**, American artist: b. Rochester, N. Y., 1865. He was a pupil of Boulanger, Lefebvre and Benjamin Constant, and received a third-class medal at the Paris salon in 1890.

**Dumont, dü-môn, Albert**, French archaeologist: b. Secy-sur-Saône, 1842; d. 1884. He



was educated in Paris, and devoting himself to the study of prehistoric, Byzantine, and Christian archaeology, published 'De Plumbeis apud Græcos Tesseriis' (1870); 'Inscriptions céramiques de Grèce' (1871); and 'Vases peints de la Grèce propre' (1873). In 1874, in Rome, and the following year in Athens, he lectured on archaeology and the history of art. In 1878 he was elected rector of the academy of Grenoble, in 1879 rector of the academy of Montpellier, and until his early death was a superintendent of higher education. The most important of his later works is 'Les céramiques de la Grèce propre, vases peints et terres cuites' (1882-90), prepared in collaboration with Chaplain.

**Dumont, dü-môn, Augustine Alexandre**, French sculptor: b. Paris 14 Aug. 1801; d. there 25 Jan. 1884. He was a most prolific worker, and his statues are found on or in many of the public buildings and churches of his native city. His most noted productions are, the colossal statues of the 'Genius of Liberty' on the Column of July, made in 1840, and the statue of Napoleon III. on the Column Vendôme.

**Dumont, Julia Louisa**, American educator and writer: b. Waterford, Ohio, October 1794; d. Vevay, Ind., 2 Jan. 1857. She has the distinction of being one of the earliest women of the West whose writings have been preserved. She contributed largely to periodicals both in prose and verse. A collection of her writings was published in a volume, 'Life Sketches from Common Paths' (1856).

**Dumont, Pierre Etienne Louis**, pē ār ā-tē-ën loo-ē dü-môn, Swiss scholar: b. Geneva 18 July 1759; d. Milan, Italy, 30 Sept. 1829. In 1785 he became tutor in London to the sons of Lord Shelburne. His superior talents soon recommended him to the illustrious Whigs of that period; with Romilly, in particular, he formed a close friendship. During the early years of the French Revolution, Dumont was at Paris, where he became greatly attached to Mirabeau, regarding whom he has given the world much valuable information in his posthumous 'Souvenirs sur Mirabeau' (1832). In this work he claims to have composed for him many of Mirabeau's most eloquent speeches. In 1791 Dumont returned to England, and formed an intimacy with Bentham (q.v.). This was the event of his life. Deeply convinced of the value of Bentham's views on legislation, he requested him to allow him to arrange and edit his unpublished writings on this subject. Bentham gave him his manuscripts, which Dumont labored earnestly to abridge, elucidate, correct, and simplify. The results appeared in his 'Traité de Législation Civile et Penale' (1802); 'Théorie des Peines et des Récompenses' (1811); 'Tactique des Assemblées Législatives' (1816); 'Preuves Judiciaires' (1823); and the 'Organisation Judiciaire et Codification' (1828). Dumont returned to Geneva in 1814, and became a member of the representative council.

**Dumont D'Urville, Jules Sebastien César**, zhül sâ-bäs-tē-ôn sâ-zâr dü-môn dūr-vêl, French navigator: b. Condé-sur-Noireau, Calvados, 23 May 1790; d. near Paris 8 May 1842. After completing his studies at Caen he entered the navy, in which he ultimately rose to be vice-admiral. He was twice wrecked and on both occasions owed his escape chiefly to self-possession and skilful seamanship. He rendered im-

portant service by his search for the remains of the ill-fated expedition of La Pérouse, the survey of long tracts of coast in New Zealand and New Guinea, the discovery of numerous islands and an antarctic continent, and the exploration of very dangerous and still imperfectly known tracts of navigation, as Torres' Straits, in Australia, and Cook's Straits, between the two large islands of New Zealand. To his contributions to geography he was indebted for his nomination to the office of president of the Paris Geographical Society. One fruit of his voyages was the 'Enumeratio Plantarum in Insulis Archipelagi et Littoribus Ponti Euxini' (1822). After his second circumnavigation, he published the 'Voyage de l'Astrolabe' (1830-9), and 'Voyage Pittoresque autour du Monde' (1834).

**Dumortierite**, a native basic silicate of aluminum, of somewhat uncertain composition. It crystallizes in fibrous or columnar forms belonging to the orthorhombic system, and has a hardness of 7 and a specific gravity of about 3.3. It is transparent or translucent, with a vitreous lustre and a blue or greenish blue color, and is strongly pleochroic. Dumortierite occurs near Lyons, France, and also in certain parts of Norway and Silesia. In the United States it is found in New York city, and in Yuma County, Arizona. The mineral is named for Eugene Dumortier, a French palæontologist.

**Dumoulin, dü-moo-lân, John Philip**, Canadian Anglican bishop: b. Dublin, Ireland, 1836. He was educated at Trinity College in the city of his birth, and emigrating to Canada was ordained priest in 1863. After an extended experience as a parochial clergyman he was appointed rector and canon of St. James' Cathedral, Toronto, in 1882, and in 1896 was elected third bishop of Niagara.

**Dumouriez, Charles François**, shärl frän-swä dü-moo-rê-ä, French general: b. Cambrai, 25 Jan. 1739; d. near Henley-upon-Thames, 14 March 1823. He entered the army early in life and at 24 years of age had received 22 wounds, and was made a knight of St. Louis. In 1772, Louis XV. sent him with communications to Sweden, but he was arrested, and for a long time confined in the Bastille. In 1789 we find him a principal director of the Jacobin club, composed of all who aspired to be accounted the friends of liberty. He afterward became a minister of Louis XVI., when he strongly advised the monarch to yield the direction of the interior affairs of the kingdom to the council of the assembly then sitting, and to declare war against the foreign foes of France. The advice was disregarded and Dumouriez was dismissed. Still determined to devote himself to the service of the army, he proceeded to Valenciennes, where he soon gained fame by his valor and his firmness, displayed at the head of the French soldiers, having succeeded Lafayette in the command of the Army of the North. He rendered very important service to his country by the stand he so skilfully made against the Prussian invaders in the forest of Argonne, in September 1792, the famous "Cannonade of Valmy" taking place on the 20th of the same month. His rapid conquest of Belgium followed. Notwithstanding his success, the Directory, not without motive, entertained suspicions regarding his designs. Dumouriez had entered into secret negotiations with the enemy, and learning that an



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accusation of treason was to be brought against him, he fled to the Austrian headquarters. He refused, nevertheless, to serve against his country; wandering for some time through Europe, and lastly settled in England.

**Dun, Edwin**, American diplomatist: b. Chillicothe, Ohio, July 1848. He went to Japan in 1873, becoming successively United States second secretary of legation, first secretary of legation, and was from 1893 to 1897 United States minister. During the war between China and Japan the Chinese government placed its interests in Japan in his care.

**Dun** (Celtic *dun*, Irish *dūn*, Gael *dūn*, a hill, castle), a word used as a prefix or suffix in the names of cities as, in Augustodunum (Autun), and in many names in Scotland and Ireland, as in Dunblane, Dundee, Dundalk, Dunboyne, etc.

**Dūna**, or **Southern Dvina**, so named to distinguish it from the northern Dvina, a west Russian river, which flows from a small lake near the source of the Volga, in the southwest of the government of Tver, and after a circuitous route of about 650 miles with a generally north-western trend, empties into the Gulf of Riga, 10 miles below Riga. For some distance it forms the boundary between the governments of Vitebsk and Livonia on the north bank, and Vilna and Courland on the south bank. Although obstructed by rocks and rapids, it is navigable for ocean vessels to Riga, for vessels of lighter draft to Dünaburg, and for flat-bottomed barges almost from its source; it commands a large river traffic; on an average it is icebound 115 days in the year. Canals connect it with the Volga, the Beresina, the Niemen, and Lake Ilmen.

**Dünaburg**, dü'nä-boorg, or **Dvinsk**, Russia, a fortified town of Russia, government of Vitebsk, on the Dūna, 112 miles southeast from Riga. It was formerly the capital of Polish Livonia. It is of great military importance, and carries on a considerable trade. Pop. 72,231.

**Dunant, Jean Henri**, zhōn ōn-rē dü-nāñ, Swiss philanthropist: b. Geneva 1828. While traveling near the battlefield of Solferino in 1859, he took part in the relief of those wounded in that battle, and realized the inadequacy of the provisions for the work. As the result of his experiences there he wrote 'Un Souvenir de Solferino,' advocating more efficient care of the wounded on the field of battle. He also lectured on the subject before the Society of Public Utility in Geneva, and enlisted the sympathy of the president and other members. A meeting of the society was called to consider the formation of permanent organizations for the relief of the wounded, and from this grew the conference at Geneva in 1864, and the Red Cross Society (q.v.). Dunant devoted his fortune to the organization and work of this society, and was pensioned by the empress of Russia. He has written 'L'Empire Romain reconstitué' (1858); 'Fraternité et Charité Internationales en Temps de Guerre' (1864); 'L'Esclavage chez les Musulmans et aux Etats Unis de l'Amérique' (1863); and 'La Rénovation de l'Orient' (1865).

**Dunbar, Paul Laurence**, American author: b. of negro parents, Dayton, Ohio, 27 June 1872. He was graduated at the Dayton high school in

1891, and since then has devoted himself to literature and journalism. Since 1898 he has been on the staff of the librarian of Congress. He has published 'Oak and Ivy' (poems) (1893); 'Majors and Minors' (1895); 'Lyrics of Lowly Life' (1896); 'Folks from Dixie' (1898); 'The Uncalled,' a novel (1898); 'Lyrics of the Hearthside' (1899); poems of 'Cabin and Field' (1899); 'The Strength of Gideon' (1900); 'The Love of Landry' (1900); 'The Spirit of the Gods,' a novel (1901); 'The Fanatics,' a novel (1901).

**Dunbar, William**, Scottish poet: b. Salton, Lothian, about 1465; d. about 1525. He was a Franciscan friar, but was often employed by James IV. in affairs of state. Among his works are the panegyric poem 'The Thistle and the Rose,' written (1503) on the marriage of James with Margaret of England, and 'The Golden Targe' (1508), consisting of allegories in the fashion of the time and of Chaucer, among them a poem on 'The Dance of the Seven Deadly Sins Through Hell.' He is at his best in burlesque poetry, as witness the autobiographical 'Visitation of St. Francis.' He is as 'rich in fancy as Spenser; as homely and shrewd as Chaucer in the 'Miller's Tale'; as pious as Cowper in his hymns, and as wittily grotesque as Burns in 'Death and Dr. Hornbook.'"

**Dunbar**, Scotland, a royal and municipal borough and seaport in Haddingtonshire, at the mouth of the Firth of Forth. It is a place of great antiquity, having originated in a castle, once of great strength and importance, which underwent several memorable sieges; on one occasion being successfully defended against the English for 19 weeks by Black Agnes, countess of Dunbar. Queen Mary and Bothwell (1567) took shelter in this castle. In 1650 Cromwell, at the "Race of Dunbar," totally defeated the Scottish army under David Leslie. The harbor, opened in 1844, is not very commodious, but the town is an important fishing station. Pop. 3,545.

**Duncan, Adam**, Viscount, Scottish naval officer: b. Dundee 1 July 1731; d. Scotland 4 Aug. 1804. He went to sea when young and was a post-captain in 1761. In the following year he served at the taking of Havana; and in 1779 he shared in the victory of Admiral Rodney over the Spaniards. In 1795 he was appointed commander of the North Sea fleet, and in October 1797, won a brilliant victory over the Dutch fleet off Camperdown, for which he was rewarded with the title of Viscount Duncan and a pension of \$10,000 a year.

**Duncan, Norman**, American journalist: b. Brantford, Ontario, Canada, 2 July 1871. He was educated at the University of Toronto 1891-5, entered journalism and is at present (1903) on the editorial staff of the New York *Evening Post*. He has written short stories and sketches for the 'Atlantic Monthly,' 'McClure's Magazine' and others, and has published 'The Soul of the Street: Stories of the New York Syrian Quarter' (1900).

**Duncan, Sarah Jeanette**. See COTES, SARAH JEANETTE.

**Duncan, Thomas**, Scottish painter: b. Kinclaven, Perthshire, 24 May 1807; d. Edinburgh 25 May 1845. He began to exhibit at the Scottish Academy in 1828, and became an aca-

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demician in 1830. The first picture which extended his fame beyond the Tweed, and helped to procure his admission as an associate of the Royal Academy (1843), was 'Prince Charles Edward and the Highlanders entering Edinburgh after the Battle of Prestonpans' (1840). Another famous picture of his is 'Charles Edward asleep after Culloden, protected by Flora Macdonald.' His last exhibited work was the 'Martyrdom of John Brown of Priesthill,' now in the Corporation Gallery of Glasgow. He also executed many portraits.

**Duncan, William Wallace**, American clergyman: b. Boydtown, Va., 20 Dec. 1839. He was graduated at Wofford College (S. C.) in 1858, becoming a minister of the Methodist Episcopal Church, South, and serving as chaplain of a Confederate regiment during the Civil War. From 1875 to 1886 he was professor of intellectual and moral philosophy at Wofford College. Since 1886 he has been a bishop of the Methodist Episcopal Church, South.

**Duncansby Head**, a picturesque promontory, forming the northeastern extremity of Scotland, in the county of Caithness. It consists of a circular rocky eminence of about two miles in circumference, and is intersected by large ravines and remarkable fissures. About a mile and a half west stood the celebrated John O'Groat's house, of which no trace now remains.

**Dunce**, a word introduced by the Thomists or disciples of Thomas Aquinas, in ridicule of the Scotists, or disciples of John Duns Scotus, schoolman, who died 1305 A.D., to denote a subtle sophist given to caviling where he cannot refute. When the reaction against the schoolmen took place at the Reformation the merits of those acute metaphysicians were temporarily decried, and the celebrated John Duns Scotus coming in for a more than ordinary share of disparagement, he, though a man of very subtle intellect, was held by the more ignorant or prejudiced of the Reforming party to be a man of invincible stupidity. He was therefore made to stand as the prototype of all modern dunces. Succeeding generations have the unfavorable verdict thus passed on the cultivators of scholastic philosophy. The schoolmen were the intellectual leaders of the age in which they lived, and rendered good service to humanity.

**Dunciad**, dūn'sī-ād, **The**, a celebrated satirical poem by Pope, in which he gibbets his critics and foes. The first three books were published in 1728; the fourth book, or 'New Dunciad,' appeared in 1742. Cibber was latterly substituted for Theobald as the hero.

**Duncker, doon'kér, Dora**, German story-writer and humorist: b. 28 March 1855. The conceits 'Incurable' (1893); 'The Sphinx,' and other tales and comedies, have succeeded; while in 'Modern Masters' (1883) she has evolved excellent character studies.

**Duncker, Maximilian Wolfgang**, German historian: b. Berlin 15 Oct. 1811; d. Anspach 21 July 1886. Politics interested him in early years, but his later energies were given to elaborate historical investigations, of which the best fruits are: 'The Crisis of the Reformation' (1845); 'Feudalism and Aristocracy' (1858); and the masterpiece 'Ancient History' (1852-7).

**Dun'combe, Thomas Slingsby**, English politician: b. 1796; d. 13 Nov. 1861. He was

elected member of Parliament for Hertford in 1824, assisted in carrying the Reform Bill, and became prominent in the extreme Liberal party. In 1842 he presented the Chartist petition, signed by 3,000,000 of the lower classes, in favor of universal suffrage, vote by ballot, short Parliaments, etc. In 1842 the then home secretary having sanctioned the opening of the letters of Mazzini, Duncombe, in the House of Commons, denounced, with scathing invective, the adoption of the post-office spy system on English soil. He was an earnest advocate of Jewish emancipation; and his motion, 1858, for placing Baron Lionel Rothschild on a committee of the House of Commons was soon followed by the concession of the right of Jewish members to sit in the House of Commons.

**Dundalk**, dūn-dāk', Ireland, a maritime town, capital of the county of Louth, on Castle-town River. It is an ancient place, and in the battle of Faughart (1318) fought in its vicinity, Edward Bruce, the brother of King Robert Bruce of Scotland, was slain. It manufactures ropes and castings, and the trade, chiefly in cattle and agricultural produce, is extensive. Pop. (1901) 13,067.

**Dundas', Henry**, **VISCOUNT MELVILLE**, Scottish statesman: b. Edinburgh 28 April 1742; d. 28 May 1811. He studied at the University of Edinburgh and in 1766 was appointed solicitor-general for Scotland. In 1782 he was appointed treasurer of the navy and made a member of the privy council; but he continued only a short time in office. In 1791 he was made home secretary, and in 1794 became secretary of war. In 1804 he was appointed first lord of the admiralty under Pitt. Next year he was impeached, before the House of Lords, "of high crimes and misdemeanors" in his former office of treasurer of the navy. As the evidence adduced against him did not directly implicate him in the malversation proved against his deputy, he was acquitted. He was long practically the manager of Scottish affairs, and also of those of India.

**Dundas', Robert**, **LORD ARNISTON**, Scotch judge, b. 9 Dec. 1685; d. 1753. He was admitted to the Edinburgh bar in 1709, and soon became known as a successful lawyer with forcible and ingenious methods of reasoning. In 1717 he received the appointment of solicitor-general, a crown appointment, which was followed by advancing positions until in 1737 he became a judge, and in 1747 rose to the dignity, which he retained until his death, of lord president of the court of sessions of Scotland. His eldest son, **ROBERT**, b. 18 July 1713, d. Edinburgh 13 Dec. 1787; was educated at Edinburgh University, studied law at Utrecht and Paris; in 1737 gained admittance to the Scottish bar, and, like his father, rose through successive crown positions to that of lord president of the court of sessions of Scotland, which he attained in 1760 and occupied until his death.

**Dundas**, Canada, a town in Wentworth County, in the province of Ontario; situated on a bay at the western extremity of Lake Ontario. It is a manufacturing and shipping centre. Pop. (1901) 3,173.

**Dundas Island**, an island on the coast of British Columbia, separated from the most southerly of the islands of Alaska by Chatham Sound.

## DUNDAS ISLANDS—DUNGLISON

**Dundas**, or **Juba**, Islands, are a group of about 500 coral islets off the east coast of Africa in lat. 1° S. The group has one safe anchorage.

**Dundas Strait**, a passage about 20 miles wide, separating Melville Island from Coburg Peninsula in northern Australia.

**Dundee, Viscount of.** See GRAHAM, JOHN.

**Dundee**, Scotland, a flourishing borough and seaport in county Forfar, on the Tay, 8 miles from the sea, and 37½ miles north-east of Edinburgh. Dundee in former times was the scene of many battles. Gen. Monk (1651) burned the place and massacred 1,000 of its inhabitants. It has a fine harbor, and splendid docks, and manufactures osnaburgs and other coarse linens, canvas and bagging for export, and colored threads and gloves. Dundee possesses many shipyards, sugar refineries, tanneries, and machine shops. Its linen trade is the largest in Great Britain. Pop. (1901) 160,871.

**Dundonald, Thomas Cochrane**, 10TH EARL OF. See COCHRANE, THOMAS.

**Dundrear'y, Lord**, a prominent character in Tom Taylor's well-known comedy of 'Our American Cousin.' The part originally contained but 47 lines, but it was enlarged by the actor, E. A. Sothorn, who became famous in this role.

**Dune**, dūn, a low sand-hill; an accumulation of sand; a hill-fort, or a regular building commonly called a Danish fort. Sand dunes are made by the blowing of sand, this material having been produced by the grinding down of rocks under the influence of breakers on the seashore or coast, or any similar agency. Such sand dunes in many places skirt the shores of Holland, Great Britain, Spain, and other countries, in some places encroaching on and covering what once was cultivated land. Originally the "downs" of England were similar to the dunes. The dunes along the Atlantic coast of the United States have changed materially the form of the coast line; some of these dunes are high hills, and still higher hills are on the coast of some of the islands of the Bahamas.

**Dune Plants**, plants characteristic of dunes, those somewhat unstable sandy areas formed under the influence of wind. The species capable of withstanding these conditions are few in number and are marked by well developed underground parts, including extensive root and numerous root-hairs, and storage organs, especially rhizomes. They are capable also of being partially buried, without apparent injury. Since some dunes are migratory, or tend to extend over wider and wider areas, thus destroying the natural vegetation, crops, and even orchards and forests, these plants are of special interest. Some of them, especially marram or beach grass, also known as sand reed (*Ammophila arenaria*), are widely planted upon beaches and dunes, to hold the sand and prevent its being blown by the wind. The United States Department of Agriculture, through its division of agrostology, has done immense service to land-owners along the shores of both the Great Lakes and the ocean coasts, in the planting of soil-binding grasses, as the plants are called. In time the planted areas support other vegetation and the dune may be consid-

ered conquered. On the other hand, should the dune advance it may disclose in its wake the remains of the vegetation it had buried. In western Michigan sand dunes have buried many peach orchards. In general the vegetation characteristic of dunes consists of xerophytes (q.v.), but the xerophytic character is due to the shifting of the sand and not to the conditions of growth. See DISTRIBUTION OF PLANTS.

**Dunedin**, dūn-ē'dīn or dūn-ēd'īn, New Zealand, town, capital of the province of Otago; on Otago harbor. It is about nine miles from its port, Port Chalmers, with which it is connected by railroad. Gold discovered nearby in 1861 has caused the recent rapid growth of the town. Wool and gold are the staple exports. Pop. (1901) 24,886; including suburbs, 52,390.

**Dunfermline**, Scotland, a town in Fife, 16 miles northwest of Edinburgh. It is a place of antiquity, from 1037 till 1650 a frequent residence of Scotland's kings, and for more than two centuries their place of sepulture. It was here that Charles II. signed the Covenant in 1650. Some of the prominent institutions now in the town are the Carnegie Library and the Carnegie Baths, the schools and the churches. Pop. (1901) 25,250.

**Dung-beetle**, a name borne by several lamellicorn beetles, of the genera *Aphodius*, *Bolbocer*, *Copris*, *Geotrupes*, *Phaneus*, and others. These beetles nest and lay their eggs in the droppings of cattle, and are found throughout America, Europe, Asia, and Africa. An African species is the sacred scarabæus of Egypt (*Ateuchius sacer*).

**Dungar'van**, Ireland, a municipal borough and seaport in the county of Waterford. It is a resort for sea-bathing. Its ancient castle, situated in the centre of the town, is now used as a barrack. The harbor is shallow and there is little trade. Fishing is the chief occupation. Pop. (1901) 4,850.

**Dungeness**, dūnj'nēs, a headland on the south coast of Kent, 11 miles southeast of Rye. It has a fort and government lighthouse.

**Dunglison**, dūng'lī-sōn, **Richard James**, American physician: b. Baltimore, Md., 13 Nov. 1834; d. Philadelphia 4 March 1901. He was a son of Robley Dunglison (q.v.). He was graduated at the University of Pennsylvania 1852, and from Jefferson Medical College 1856. During the Civil War he served as surgeon in the Philadelphia military hospitals. He soon gave up the practice of medicine in order to devote himself to literary work and it is by his contributions to medical literature that he is best known, having edited the 'College and Clinical Record' 1880-99, and written constantly for the leading medical journals. He was also one of the original editors of the Philadelphia 'Medical Times.' He revised and edited the following works of his father: 'History of Medicine' (1872), and 'Medical Lexicon' (1874); translated Guersant's 'Surgical Diseases of Children' (1873); and was author of: 'The Practitioner's Reference Book' (1878); 'Elementary Physiology' (1879); 'The Present Treatment of Disease' (1886).

**Dunglison**, Robley, American physician: b. Keswick, England 4 Jan. 1798; d. Philadelphia 1 April 1869. He was educated in medicine at London and Erlangen, and appointed professor

## DUNITE — DUNKIRK

of medicine in the University of Virginia in 1824. In 1833 he was elected to the chair of therapeutics in the University of Maryland, and in 1836 professor of the institutes of medicine in the Jefferson Medical College of Philadelphia. He published about 20 volumes treating of subjects connected with medical science. They were widely circulated and highly valued in their day, one of them, a 'Dictionary of Medical Science and Literature,' being republished as late as 1874.

**Dun'ite**, a heavy, dark, very basic igneous rock of the peridotite group. It contains no felspar and consists essentially of olivene and chromite. It is believed that most workable deposits of chrome iron ore were formed by local segregations of chromite in a cooling dunite magma, at least the chromite deposits of North Carolina probably had such an origin. Dunites in common with other rocks of the peridotite group change readily to serpentine, and most deposits of chromite occur in serpentine. See PERIDOTITE.

**Dun'kards, Dunkers, or Tunkers** (Ger. *tunken*, to dip, Lat. *tingere*, Gr. *τέγγειν*) a sect of German-American Baptists, founded by Alexander Mack in 1708 in Westphalia. Persecution at home drove them across the Atlantic. Their doctrines resemble those of the Mennonites (q.v.). They derive their name from their mode of baptizing by immersion. They reject infant baptism; use great plainness of dress and language; refuse to take oaths or to fight; and anoint the sick with oil in order to effect their recovery, depending on this unction and prayer, and rejecting the use of medicine. Every brother is allowed to speak in the congregation, and their best speaker is usually set apart as their minister, ordaining him by the laying on of hands, attended with fasting and prayer. They also have deacons, and aged women for deaconesses. From among the teachers who have been tried, they choose bishops. An elder among them is, in general, the first or oldest chosen teacher in a congregation which has no bishop. Their annual meeting, which is held about Whitsuntide, is attended by the bishops, teachers, and other representatives chosen by the congregations. The important cases brought before these meetings are, in general, decided by a committee of five of the oldest bishops. They will not go to law, and until lately the taking of interest on money was not allowed among them. They celebrate the Lord's Supper, with its accompanying usages of love feasts, the washing of feet, the kiss of charity, and the right hand of fellowship. They believe in general redemption, though it is with them not an article of faith; but they deny that they are Universalists. From the Dunkers, as a sect, must be distinguished the Seventh Day Dunkers, also called the German Seventh Day Baptists. They were established by Conrad Beissel, a native of Germany, who had been educated for the ministry at Halle. When a member of the Dunker society at Mühlbach (Mill Creek), in Lancaster County, Pa., he published (1725), a tract, to prove that the seventh day, and not the first day, was established by Jehovah for ever as the Sabbath. This created some disturbance in the society at Mill Creek, upon which he retired from the settlement and went secretly to a hermitage on the banks of the Cocalico. Having been discov-

ered, and joined by many of the society at Mill Creek, who settled around him in isolated cottages, the first community of Seventh Day Dunkers was established in 1728. In 1733 a monastic society was established, constituting with the buildings subsequently erected by the community, the irregular enclosed village of Ephrata. The habit of the capuchins or white friars was adopted by both the brethren and sisters. Monastic names were given to all who entered the cloister. In 1740 there were 36 single brethren in the cloister and 35 sisters, and at one time the society, including the members living in the neighborhood, numbered nearly 300. The property which belonged to the society by donation, and the labor of the single brethren and sisters were common stock; but none were obliged to throw in their own property or give up any of their possessions. They considered celibacy a virtue, but never required it, nor did they take any vows in reference to it. When two wished to be joined in wedlock, they were aided by the society. In the earlier days the idea of a universal restoration existed among them; but it has never been taught as an article of faith, and is always approached with caution. The Dunkards in this country have dispersed themselves through almost every State of the Union, especially Pennsylvania, Maryland, Virginia, Ohio, and Indiana. In 1900 they reported 2,998 ministers; 1,129 churches; and 111,481 communicants. See GERMAN BAPTIST BRETHREN.

**Dunkin, Edwin**, English astronomer: b. Truro 19 Aug. 1821; d. 26 Nov. 1898. In 1838 he joined the staff of the Royal Observatory at Greenwich, becoming in 1881 chief assistant, a post which he resigned in 1884. In 1845 he was elected a Fellow of the Royal Astronomical Society, and in 1876 of the Royal Society. From 1884 till 1886 he acted as president of the former body. He published several works, among which are: 'On the Movement of the Solar System in Space determined from the Proper Motions of 1,167 Stars' (1863); 'On the Probable Error of Transit Observations' (1860-64); 'The Midnight Sky: Familiar Notes on the Stars and Planets' (1869); 'Obituary Notices of Astronomers' (1879).

**Dunkirk**, dūn'kèrk (Fr. *Dunkerque* or *Dunquerque*), France, town in the department of Nord, on the coast of the North Sea, 40 miles northwest of Lille, at the junction of several canals. Of the public squares, that of Champ de Mars and that adorned by a statue of Jean Bart (1845) are the most noteworthy. There are several interesting churches, among the chief being the church of St. Eloi, built about 1560, with a fine tower about 300 feet high, now used as a belfry; the chapel of Notre-Dame des Dunes, founded in 1405 and restored in 1815; and the convent and church of St. Jean-Baptiste. Dunkirk is well protected by several forts, both on the land side and on that of the sea. Its manufactures are extensive, comprising fishing-nets, ropes, sail-cloth, straw hats, starch, soap, leather, earthenware, oil, and chemicals, besides distilling, sugar-refining, and other industries. Dunkirk is the chief port of departure of the French Iceland fishing fleets. The trade is extensive and important. Dunkirk was a town under its present name, which means "the

## DUNKIRK—DUNN

church of the dunes," in the 9th century. It has played a prominent part in many wars, and has been besieged on many occasions. The present commercial importance of Dunkirk dates from the period of the second empire. One of the most famous natives of the town is Jean Bart (1651-1702), the celebrated seaman. Pop. 49,215, with the suburbs Rosendael and Saint-Pol-sur-Mer, about 55,000.

**Dunkirk, N. Y.**, city in Chautauqua County; on Lake Erie, and the Erie, the Nickel Plate, the Lake Shore, the Western N. Y. & P., and the Dunkirk, All. V., and P. R.R.'s; 40 miles southwest of Buffalo. It is a good shipping port, having a good harbor and facilities for freight handling. Its industries include a plant for the manufacture of locomotives, foundry, planing-mills, grain-mills, grain and coal elevators, and various other factories. It is a popular summer resort, with a beautiful park overlooking Lake Erie, and has a public library, orphan asylum, public and parish schools, and a national bank. Pop. 12,500.

**Dunlap, William**, American dramatist and painter: b. Perth Amboy, N. J., 19 Feb. 1766; d. New York 28 Sept. 1839. He painted George Washington's portrait and for five years (1784-9) worked under West in London. Returning to America he wrote several successful plays, including: 'The Father' (1789), a comedy; 'Leicester' (1794), a tragedy; 'André' (1798), a tragedy. He also published: 'Life of George Frederick Cooke' (1813); 'Life of Charles Brockden Brown' (1815); 'History of the American Theatre' (1832); 'History of the Rise and Progress of the Art of Design in the United States' (1834); and similar works. He was one of the founders of the National Academy of Design.

**Dunlin** (*Tringa alpina*), a bird of the genus to which the least and pectoral sandpipers, knot, and stint belong. It is smaller than the common snipe; is in winter ashy-gray above, white below, with dark spots on the breast; in the breeding season it is mottled with rufous above and the breast is crossed with black. The straight bill is adapted for boring in soft soil, and its cavity reaches to the extremity, not, as in the snipe, stopping short of the tip. The dunlin is one of the most common shore birds in northern Europe and Asia, and sometimes wanders into North America, where it is replaced by the closely allied redbacked sandpiper. In Scotland there are several local varieties, those of the east being a half larger than those of the Hebrides. It breeds on moors and marshes along with the snipe and plover, returning after the breeding season to the sandy and muddy reaches of the coast. See SANDPIPER.

**Dunlop, George Thomas**, American capitalist: b. Otterburn, Frederick County, Md., 25 March 1845. He entered business at 15, and set up for himself as G. T. Dunlop & Co. in 1870, retiring from business with a fortune in 1890. He was for many years director of the Washington & Georgetown Railroad Company, of which he was elected president in 1894. When this company obtained extensive new franchises from Congress, and changed its name to the Capital Traction Company in 1895, he was elected president of the new corporation.

**Dunmore, John Murray**, EARL OF, English colonial governor: b. 1732; d. Ramsgate, England, May 1809. He was appointed governor of New York in 1770, and governor of Virginia in 1771. He dissolved the Virginia Assembly in 1772, and again in 1774 when it had resolved to keep the day of the closing of the port of Boston as a day of fasting and prayer. In 1775 he removed a powder magazine to one of the English war ships, and the people incensed at this, began armed resistance under the leadership of Patrick Henry. Dunmore was forced shortly after to take refuge on his fleet, and kept up a predatory warfare against the colonists, burning Norfolk in 1776. He was driven from his position on Gwynn's island and finally sent the fleet to the West Indies, and returned to England. He was appointed governor of the Bahamas in 1786. See COLONIAL WARS IN AMERICA.

**Dunmore, Pa.**, a borough in Lackawanna County, on the Erie & L. R.R.; two miles northeast of Scranton. It is the centre of a coal mining district, and has manufactures of silk, iron, and brick. Several public institutions are located here, the principal one being the State Oral School for the deaf and dumb. Pop. 12,600.

**Dun'mow, Great and Little**, two parishes of England, in the county of Essex. The former contains the market-town of Great Dunmow, on a height above the Chelmer, 32 miles northeast of London. At Little Dunmow are remains of a stately Augustinian priory, founded in 1104. The Dunmow flitch of bacon was a prize instituted in 1244, by Robert Fitzwalter, on the condition "that whatever married couple will go to the priory, and kneeling on two sharp-pointed stones, will swear that they have not quarreled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon." The prize was first claimed in 1445, 200 years after it had been instituted. After 1751, up to which date only five presentations had taken place, the flitch was not again claimed till 1855; between 1860 and 1877 there were four awards; and three in 1891.

**Dunn, Gertrude Colmore Renton**, English novelist. She was educated in Germany and Paris, and in 1882 was married to H. A. C. Dunn. After his death she was married in 1901 to H. B. Weaver. She has published: 'Concerning Oliver Knox' (1888); 'A Conspiracy of Silence' (1889); 'A Living Epitaph' (1890); 'A Valley of Shadows' (1892); 'A Daughter of Music' (1894); 'Poems of Love and Life' (1896); 'Love for a Key' (1897); 'Points of View' (1898); 'The Strange Story of Hester Wynne' (1899); 'The Marble Face' (1900).

**Dunn, Jacob Piatt**, American journalist and author: b. Lawrenceburg, Ind., 12 April 1855. He was educated at Earlham College, Ind., and Michigan University, and was State librarian of Indiana 1889-93, when he became an editorial writer on the Indianapolis *Sentinel*. Since 1886 he has been secretary of the Indiana Historical Society. He has published: 'Massacres of the Mountains, a History of the Indian Wars of the Far West' (1886); 'His-



tory of Indiana' (1888), in the 'American Commonwealth Series'; 'The Tax Law of Indiana and the Science of Taxation' (1891); 'The Libraries of Indiana' (1892); 'The World's Silver Problem' (1894).

**Dun'nage**, a nautical term applied to loose wood or other miscellaneous substances, used in the hold of a ship to lift the cargo above bilge-water. Again, such articles as old mats or sails stowed among casks and other cargo, to prevent their motion and breakage. See **CHOCKS**.

**Dunne, Edward Joseph**, American Roman Catholic clergyman: b. Tipperary, Ireland, 1848. He came to the United States when an infant, was educated at the theological seminary in Baltimore, and ordained priest in 1871. He was appointed bishop of Dallas, Texas, in 1893. His diocese grew steadily under his administration till in 1900 it contained 32 churches and 21 parochial schools.

**Dunne, Finley Peter**, American journalist and humorist: b. Chicago 10 July 1867. He was educated in the Chicago public schools and entered journalism in 1885. He was city editor of the *Chicago Times* 1891-2; was on the editorial staff of the *Chicago Evening Post* and *Times-Herald* 1892-7; and editor of the *Chicago Journal* 1897-1900. He is author of 'Mr. Dooley in Peace and War' (1898); 'Mr. Dooley in the Hearts of His Countrymen' (1898); 'Mr. Dooley's Philosophy' (1900); 'Mr. Dooley's Opinions.'

**Dun'net Head**, a promontory of Scotland, in Caithness, at the western entrance of, and projecting into the Pentland Firth; the most northern point of the mainland of Great Britain. It rises to the height of 400 feet above sea-level. On the northwestern extremity is a lighthouse 346 feet high.

**Dunning, Edwin James**, American author: b. Camillus, N. Y., 19 July 1821; d. Cambridge 1901. He practised dentistry at Ithaca and Syracuse, N. Y., 1838-44, and in New York 1844-74. In 1877 he lost his eyesight and took up the study of literature. He published: 'Genesis of Shakespeare's Art: a Study of His Poems and Sonnets' (1897).

**Dunning, John**, (BARON ASHBURTON), English lawyer: b. Ashburton, Devonshire, 18 Oct. 1731; d. Exmouth, Devonshire, 18 Aug. 1783. He established his reputation in 1762 by drawing up a defense of the East India Company against the claims of the Dutch; and his already large practice was immensely augmented by his arguments on the side of Wilkes in the question of the general warrants. In Parliament he remained a firm opponent to the ministry who conducted the American war; and on the return of Lord Shelburne to power in 1782 he was made chancellor of the duchy of Lancaster, and advanced to the peerage.

**Dunning, William Archibald**, American educator: b. Plainfield, N. J. He was graduated at Columbia 1881, and became successively fellow 1886-8; prize lecturer in political science 1887-9; instructor in history 1889-91; and professor of history and lecturer on political theory since 1891. In 1894 he became managing editor of the 'Political Science Quarterly,' to which he has contributed over 60 important articles and reviews. He has pub-

lished: 'Essays on the Civil War and Reconstruction, and Related Topics' (1898); 'History of Political Theories, Ancient and Mediæval' (1902).

**Dunnottar**, dūn-nōt'tar, a parish of Kincardineshire, Scotland, famous for its ancient ruined castle. The older part of the ruins probably belongs to about 1394, when the castle was rebuilt by Sir William Keith, marischal of Scotland. During the Commonwealth the castle was selected as the strongest place in the kingdom for the preservation of the Scottish regalia. Lambert, one of Cromwell's generals, besieged the place, which was starved into capitulation. The regalia had, however, been previously removed by a stratagem, in which Mrs. Granger, the wife of the minister of an adjoining parish, played the chief part. She brought away the crown hid among some clothes in her lap, her servant-maid carrying the sword and sceptre in a bag of flax on her back. In Dunnottar churchyard, near Stonehaven, Sir Walter Scott met Robert Paterson, the original 'Old Mortality.'

**Dunois, Jean**, zhōn dū-nwā, COUNT OF ORLEANS and OF LONGUEVILLE, French soldier: b. Paris 23 Nov. 1402; d. St. Germain-en-Laye, near Paris, 24 Nov. 1468. He was a natural son of Louis, Duke of Orleans, and made the name "Bastard of Orleans" illustrious by his military exploits in the war for the liberation of France, then completely in the power of England. Being besieged by the English he defended Orleans with the greatest courage until relieved by the Maid of Orleans. To Dunois belongs almost entirely the honor of expelling the enemies of his country from Normandy and Guienne. In 1450 he had completely freed France from the presence of the English, and it may truly be said that Charles VII. was indebted to him for his crown. Dunois received from him the title of "deliverer of his country," the county of Longueville, and the dignity of high chamberlain of France.

**Dunoon**, dūn-oon', Scotland, a celebrated watering-place in the county of Argyre, on the shore of the Firth of Clyde, 25 miles west by north from Glasgow. There is an immense passenger traffic here in the summer season carried on by means of the Clyde steamers. On a hill are the ruins of Castle Dunoon, the ancient residence of the Argyles.

**Dunquerque**. See **DUNKIRK**.

**Dunra'ven**, Windham Thomas Wyndham-Quin, 4TH EARL OF: b. Adare, Ireland, 12 Feb. 1841. He was educated at Christ Church, Oxford; was war correspondent for the *Daily Telegraph* in Abyssinia in 1867 and again in the Franco-Prussian war, and succeeded to the title in 1871. He was under-secretary for the Colonies in Lord Salisbury's two administrations, but resigned in 1887. He is a traveler and yachtsman and has published: 'The Great Divide: the Upper Yellowstone' (1874); 'The Irish Question' (1880); 'Self Instruction in the Theory and Practice of Navigation' (1900).

**Duns, John**, Scottish physicist: b. 11 July 1820. He was educated at Edinburgh University and entered the ministry of the Free Church of Scotland in 1843. He was pastor at Torphichen in 1844; editor of 'North British Review' (1857), and has been professor of natural sci-



ence in New College, Edinburgh from 1864. Among his published works are: 'Things New and Old' (1857); 'Biblical Natural Science' (1863-6); 'Science and Christian Thought' (1866).

**Dunsinane**, dūn-sī-nān', one of the Sidlaw Hills in Perthshire, 1,012 feet high, nine miles northeast of Perth. On its top are remains of a fortress "Macbeth's Castle." Here Siward defeated Macbeth in 1054. Shakespeare made use of this battle in his 'Macbeth.'

**Dun'stan, Saint**, English prelate and statesman: b. Glastonbury about 924; d. Canterbury 19 May 988. His family was a notable one and related to the royal line of the Anglian kings. He was educated in whatever of science and liberal arts existed in that time, by certain Irish monks settled at Glastonbury, and he was proficient in music (including music composition), in painting, and the mechanic arts. His career proves him to have been gifted with administrative talents of the first order. At an early age he entered the service of King Athelstan and continued in that of his successor Edmund, but his superior accomplishments provoked the enmity of his rivals at court, by whom he was set upon with outrageous violence and driven out. He then went to his uncle, Ælpheg, bishop of Winchester, and when convalescent from an attack of brain fever brought on by the rough handling to which he had been subjected, took the religious vows and became a monk. He now entered upon a course of asceticism, such as was in that age deemed to be the most perfect way to heaven and an essential part of the life of whoever would walk in Christ's footprints; and hence from the time of the change of religion in the 16th century until lately Dunstan has been rated by those outside of the Roman Catholic Church merely as a fanatical and grossly superstitious monk, and his wisdom as churchman and statesman reputed as "monkish cunning." But modern historic research has begun to do justice to this man, who was without question an enlightened statesman and a wise Church reformer.

At the age of 22 he was made abbot of Glastonbury by King Edmund, who also appointed him principal state treasurer. Under Edmund's successor Edred (946-55), who was of feeble constitution, Dunstan was in all but name ruler of the kingdom and a wise and vigorous administrator. Under Edwy, who succeeded Edred, he courageously sought out the king while he was in the company of his destined bride, Elgiva, and to his face denounced the intended union as incestuous. For this action he was outlawed and for a few months was in exile at Ghent; but when Edwy's brother Edgar, a youth, became king of Mercia and Northumberland, he chose Dunstan for his chief minister and at the same time he was appointed bishop of Winchester; in 960 he was promoted to the primatial see of Canterbury. Now it was that Dunstan, as archbishop of Canterbury and principal minister of state, began to execute fully the policy for which his memory has been execrated in modern times. He forcibly expelled from all abbeys, cathedrals and churches to which his power as minister of state extended, all married and concubinary priests, supplanting them with monks where he could; and making the canons of his own cathedral chapter a mo-

nastic college. In dispossessing the married clergy he simply enforced the laws of the Church which required her ministers to be celibate; and in reforming his cathedral chapter he appears to have exercised a wise discretion; there were evils rampant in the Church in those times that cried out for stern correction. In that same reign, in which he was all-powerful, he induced the king to visit in person every part of his realm annually, holding courts of justice, hearing appeals, and becoming acquainted with the needs of the people. A strong fleet was maintained off the coast against the Norse pirates; the coinage was reformed; rewards were paid by the Crown for the extermination of beasts of prey. Edgar's successor, Edmund, owed chiefly to Dunstan his elevation to the throne, and the archbishop continued still to be principal minister of state; but when Edmund was murdered, 979, the archbishop's influence under his successor, Ethelred, "the unready," was small, and disasters befell the kingdom thick and fast; the Danes ravaging the coasts and pillaging and slaughtering the people inland. The archbishop passed the closing years of his life in retirement, going back to the favorite studies and pursuits of his youth — music, painting, calligraphy, the making of musical instruments, and bell-founding. Consult: Stubbs, 'Memorials of Saint Dunstan'; Butler, 'Lives of the Saints'; Starr, 'Patron Saints'; Osborn; Eadmer.

**Dun'ster, Henry**, 1st president of Harvard College: b. Lancashire, England, about 1612; d. Scituate, Mass., 27 Feb. 1659. He was inaugurated president Aug. 27, 1640, and held his office until 1654, when, having become a supporter of the principles of the modern Baptists, he was persuaded to resign his office. He was respected as a modest and pious man, and esteemed an excellent Oriental scholar.

**Dunton, John**, English bookseller and author: b. Graffham, Huntingdonshire, 4 May 1659; d. 1733. He came to New England in March, 1686, with a cargo of books and remained about eight months. He conducted a weekly called the 'Athenian Mercury,' resolving all the curious questions proposed by the inquiring, of which 20 volumes appeared. A selection from this was made, called the 'Athenian Oracle.' He wrote voluminously on religion, ethics, and politics, filling his works with information which is no less entertaining for being subservient to the author's vanity. Among his writings are: 'Life and Errors of John Dunton'; and 'Letters from New England,' which was published in 1867. In this he relates many curious facts in relation to the bookselling business, describing the ministers, booksellers, and other citizens of Boston and Salem.

**Dunwoody, Henry Harrison Chase**, American meteorologist: b. Highland County, Ohio, 23 Oct. 1842. He was graduated at the U. S. Military Academy in 1866 and from the Columbia Law School in 1876 and having been detailed in 1872 for duty on the Signal Corps, was appointed in 1891 to the Weather Bureau, then first constituted. His special work has been that of formulating official forecasts of the weather, and he originated the system of cold-wave warnings; in this connection he recommended the organization of State weather services. He is the author of many papers on

meteorological subjects published by the Signal Service.

**Duodec'imal Scale.** See ARITHMETIC; SCALE.

**Duodecimal System,** in numeration, a system of numbers the scale of which is 12. Duodecimals is a term applied to an arithmetical method of ascertaining the number of square feet, etc., in a rectangular area or surface, whose sides are given in feet, inches, and lines. In recent times it has been proposed to substitute for the present decimal scale of 9 digits and a cipher a duodecimal scale of 11 digits and a cipher, thus making 12 its base. In favor of the system it is urged that 12 admits of a greater number of division into equal parts by 2, 3, 4, and 6; but most mathematicians consider it as not having sufficient superiority over decimals to counterbalance the immense inconvenience of making a change. The great superiority of duodecimals in the practical, everyday affairs of trade, commerce, and ordinary business is so great, that no laws in any manufacturing or commercial country can be made that can compel the use of decimals to the displacing of dozens and grosses.

**Duodenitis,** dü-ō-dē-nī'tis, a term used in pathology, is inflammation of the duodenum, the first portion of the small intestine. It frequently results from an acute gastric irritation and is, in a large number of cases, the affection which causes biliousness. The main symptoms are headache, languor, nausea, loss of appetite, constipation, coated tongue, foul breath, and, at times, a certain amount of jaundice. This latter is due to the fact that the inflammation in the duodenum causes a swelling of the mucous membrane of the common bile duct and leads to partial occlusion of its passage, thus damming back a certain amount of bile, hence the term biliousness. The treatment is by means of careful diet, hot water and hygienic living. See INTESTINE; ENTERITIS.

**Duodenum,** dü-ō-dē'nūm, in anatomy. See INTESTINE.

**Dupanloup, Félix Antoine Philibert,** fā-lēks ān-twān fē-lē-bēr dü-pān-loo, French prelate and theologian: b. St. Félix, Savoy, 3 Jan. 1802; d. Lacombe, Isère, 11 Oct. 1879. He received a clerical education at Paris and after ordination to the priesthood was appointed chaplain to the Count of Chambord and religious instructor of the young princes of the house of Orleans. In 1837 he was made one of the vicars-general of the archbishop of Paris and head of the Petit Séminaire de St. Nicolas du Charbonnet which, under his direction, ceasing to be merely a preparatory school for aspirants to the clerical state, received as students the sons of the highest nobility. Ernest Renan, who was one of the clerical students, recounts in his 'Recollections of My Youth' a pleasing anecdote illustrating "the noblest trait in Dupanloup's character," his affection for his mother. It was Dupanloup who in 1838 attended Talleyrand on his death bed as minister of religion, and brought about what passed for a reconciliation of the apostate bishop with the Church. Renan reports Talleyrand as having remarked when told that the Abbé Dupanloup was to offer his ministrations, "This young man does not know his business"; but in Renan's judgment "never was there priest so well up in his calling." All his

life Dupanloup took a lively interest in charitable projects and in measures for extending to the masses the benefits of school education. He combated the endeavors of that party in the Church which sought to displace in institutions of higher education the ancient Greek and Latin classics as being pagan, and to substitute in their room the Fathers of the Church—the Basils, the Chrysostoms, the Augustins and the Jeromes. He was made bishop of Orleans 1849; was elected to the French Academy 1854; but withdrew in 1871 when against his earnest protest Littré, the leader of the Positivists, was chosen to be a member; that same year he was elected to the National Assembly and was several times re-elected; in the Assembly he was the leader of the clerical party, so-called, and ever took an active part in discussions of matters of public education. In the Vatican Council he stood with the minority in opposition to the decree of infallibility, but was one of the first to make an act of submission. Nominated 1871 to be archbishop of Paris, he declined that office. He was a great pulpit orator, worthy of a place beside the great sacred orators of France. His writings are voluminous, dealing almost wholly with questions of education and church interests. Two of his works which are in every good pedagogical library are: 'The Child' and 'The Ministry of the Catechist.' Consult: Pelletier, 'Monseigneur Dupanloup.'

**Dupaty, Charles Marguerite Jean Baptiste Mercier,** shārl mār-gā-rēt zhōn bāp-tēst mār-sē-ā dü-pā-tē, French jurist: b. La Rochelle, France, 9 May 1746; d. Paris 17 Sept. 1788. In 1767 he became advocate-general to the parliament of Bordeaux, and having written in its name against the Duke of Aiguillon, when this nobleman became minister (1770) he was sent to Pierre-en-Cise (a fortress at Lyons, once a state prison), and afterward banished until the accession of Louis XVI. The memorial by which he preserved the lives of three innocent citizens of Chaumont who were condemned to the wheel deserves particular mention. His other works are: 'Reflexions Historiques sur les Loix Criminelles,' a valuable work; various 'Discours Académiques'; and 'Lettres sur l'Italie en 1785,' which appeared in 1788.

**Dupaty, Louis Marie Charles Mercier,** loo-ē mā-rē shārl mār-sē-ā, French sculptor: b. Bordeaux 29 Sept. 1771; d. Paris 12 Nov. 1825. He was a son of the preceding. He was the restorer of sculpture in France, a member of the Institute, and professor in the École des Beaux Arts; was at first an advocate, served during the Revolution as a dragoon, then as cartographer, and finally went to Rome, where he studied sculpture and made himself known by numerous works. His principal productions are 'Ajax Pursued by Neptune,' his equestrian statue of Louis XIII. (1816), and 'Orestes Pursued by the Furies.'

**Duperré, Victor Guy,** vĕk-tōr gē dü-pĕ-rā, BARON, French naval officer: b. La Rochelle 20 Feb. 1775; d. Paris 2 Nov. 1846. After various gallant naval adventures Duperré in 1811 was raised to the rank of vice-admiral, and commanded in the Mediterranean. In the beginning of 1812 he was naval commander-in-chief in the Adriatic, and during the Hundred

Days guarded Toulon against the attempts of the British and Sicilian troops which landed at Marseilles. In 1823 he commanded the squadron employed in the siege of Cadiz. In 1830 he superintended the landing of the troops on the coast of Algiers, and contributed greatly to the capture of the capital. After the Revolution of July he was raised to the peerage, and held the portfolio of marine, first from 1834 to 1836, and again in the ministry of 1840.

**Duperron, Jacques Davy**, zhāk dā-vē dū-pě-rôn, French ecclesiastic: b. St. Lô, Normandy, 15 Nov. 1556; d. Paris 6 Sept. 1618. His father, a physician, having embraced the Reformed religion had to flee from France and settled at Bern in Switzerland, where he became a Protestant minister. The son, having received at Bern a superior education, came to Paris at the age of 20, and having been there received into the Roman Catholic Church was appointed reader to the king, Henry III., and afterward adopted the clerical profession. He pronounced the eulogy of Mary Queen of Scots, after her execution, and seized the opportunity to make an attack on Queen Elizabeth; and though the French court disavowed any approval of the discourse and expressed a formal censure of it, the incident marked the beginning of the young ecclesiastic's good fortunes. In the matter of the Cardinal de Bourbon's plot to succeed to the throne after the death of Henry III., he was charged with having joined the Cardinal's faction and betrayed its secrets to Henry of Navarre (Henry IV.). The charge seemed to get confirmation from the fact that after Henry ascended the throne he made Duperron bishop of Evreux. He was the Church's agent in bringing about Henry's conversion to the Roman Catholic faith. In his diocese of Evreux he had great success in checking the advance of Calvinism and bringing seceders back to the Church. He was in Rome on the king's business in 1604 when Clement VIII. died, and was largely instrumental in securing the election first of Leo XI. and then of Paul V., who in less than a month succeeded Leo. He was now made archbishop of Sens and cardinal. Contrary to the principles of Gallicanism he was a zealous advocate of the doctrine of papal infallibility and of the Pope's superiority over a general council of the Church.

**Dupetit-Thouars**, dū-pě-tē too-ār, **Abel Aubert**, French naval captain: b. Boumois, Saumur, 31 Aug. 1760; d. 1 Aug. 1798. When a mere boy he was so smitten with the love of a sea life by reading 'Robinson Crusoe' that he ran off from the military school of Laflèche and attempted to enter himself as a cabin-boy in a vessel at Nantes, but was discovered and sent back. At length, in 1778, he had an opportunity of entering the navy, and distinguished himself on several occasions in the West Indies. On the expedition to Egypt in 1798 he commanded an 80-gun ship. He foresaw the only result which could be anticipated if it was resolved to wait for Nelson's attack in the place selected in the roads of Aboukir, and advised immediately to set sail. But though his advice was disregarded he fought with undaunted valor against the enemy, and fell in the struggle. His MSS. and correspondence

were published under the title of 'Lettres, Mémoires et Opuscules d'Aristide Dupetit-Thouars.'

**Dupin, André Marie Jean Jacques**, än-drä mä-rē zhôn zhāk dü-pân, French lawyer and advocate: b. Varzy 1 Feb. 1783; d. Paris. He attained first rank at the French bar, defending Marshal Ney and Beranger. He was the eldest of the famous brothers styled "the three Dupins."

**Dupin, Jean Henri**, zhôn ön-rē, French dramatist: b. Paris 1 Sept. 1791; d. there 5 March 1887. He was a brother of André Dupin (q.v.). His plays were staged with great success.

**Dupin, Louis Ellies**, French church historian: b. Paris 17 June 1657; d. there 6 June 1719. In 1680 he received the degree B.D. at the Sorbonne, and in 1684 the degree D.D., and then or previously commenced those researches into the history of the Church which resulted in his celebrated 'Universal Library of all the Ecclesiastical Writers' (Vol. I., 1686). The freedom with which in this volume he discussed the teachings of the Fathers of the Church brought upon the work its condemnation by the archbishops of Paris and it was suppressed; but the author having made a retraction and changed "universal" in the title to "new," he was permitted to continue the series, though later he was banished, and restored only after a new retraction. He sought to effect a union between the Anglican and Gallican churches and had a correspondence to that end in 1718 with the Anglican primate, Archbishop Wake. He was now charged with endeavoring to subvert the dogmas of the Roman Catholic Church, and his papers were seized in 1719, in the expectation that they would give proof of the charge; but nothing was found that seriously compromised him. He seems to also have conferred with Peter the Great with a view to union of the Gallican and Russian churches. The 'Library of Ecclesiastical Authors' is a very voluminous work of immense erudition and is a complete history of theological literature within the Roman Catholic Church, both Eastern and Western, to the close of the 17th century; it was soon translated into English. Besides this, his greatest work, he wrote many others, among them: 'Universal Library of Historians'; 'Abridgment of Church History'; 'General History from the Beginning of the World to the Present Time' (1712).

**Dupin, Pierre Charles François**, pē-är shärî frân-swä, French engineer: b. Varzy 6 Oct. 1784; d. Paris 18 Jan. 1873. He was a brother of André and Jean Henri Dupin (qq.v.). He performed many notable engineering feats in the government service, and was made a baron and a senator.

**Dupleix, Joseph François**, zhō-zěf frân-swä dü-pläks, French colonial governor: b. Landrecies, France, 1 Jan. 1697; d. Paris 10 Nov. 1764. In 1720 he was appointed to a seat in the council at Pondicherry. Ten years later he became superintendent at Chandernagore in Bengal. The remarkable success of his administration here led to his being appointed, in 1741, governor-general of all the French Indies, with the title of Nawab. He now successfully pursued that policy of patient, skilful

## DUPONCEAU — DUPONT

diplomacy among the native princes which at one time made the Carnatic almost a French province. When war broke out in Europe between France and England (1740), several brilliant engagements planned by Dupleix took place between the French garrison and the troops of the Nawab of the Carnatic, who endeavored to take possession of Madras, but was precipitately forced to raise the siege. An attack on the English at Fort St. David failed, but Dupleix's science and courage were displayed in the defense of Pondicherry, which Admiral Boscawen in vain attacked for five weeks, with an apparently overwhelming force, but was forced to retire discomfited, though the defense was conducted by a civilian, unsupported by a single general of repute. The ambitious mind of Dupleix had long formed the project of founding a French empire in India on the ruins of the Mogul monarchy, but his military designs, able as they were, were frustrated by the energy and military genius of Clive and Lawrence. The struggle continued till 1754, in which year Dupleix was recalled by Louis XV.

**Duponceau, dü-pôn'sō, Fr. dü-pôn-sō, Peter Stephen,** American lawyer and scholar: b. St. Martin, Isle de Ré, France, 3 June 1760; d. Philadelphia 1 April 1844. For a time he was secretary to Count de Gébélín, and afterward to Baron Steuben, with whom he came to the United States in 1777. Receiving a captain's commission he served with Steuben through the American Revolution and after its close settled in Philadelphia and became noted as a lawyer. For several years he was much interested in an effort to introduce into the United States the production and manufacture of silk. His writings are of a miscellaneous character, among which may be mentioned original treatises on points of law; translations from the Latin, German, and French on similar subjects; various treatises on philology; numerous contributions to American history, including a translation of 'A Description of New Sweden,' by Thomas Campanius Holm. He was a member of more than 40 literary and scientific institutions of Europe and America, including the American Philosophical Society, the Historical Society of Pennsylvania, and the Philadelphia Athenæum, of which three institutions he was the presiding officer at the time of his death.

**Dupont, dü-pönt', Henry Algernon,** American military officer: b. Wilmington, Del., 30 July 1838. He is a grandson of E. I. Dupont (q.v.). He was graduated at the United States Military Academy, served through the Civil War, taking part in the battles of Piedmont, Lynchburg, Cedar Creek, Opequan, and Fisher's Hill, and was brevetted major-general for gallantry in the two last-mentioned battles, and lieutenant-colonel for services at Cedar Creek. He became proprietor of the celebrated powder mills bearing his name near Wilmington, Del., and under his direction they became an important factor in the Civil War. He resigned from the army in 1875; became president of the Wilmington & Northwestern Railroad Company in 1879; and was chosen United States senator from Delaware in 1895, but was not seated.

**Dupont, Jacques Charles, zhāk shärl dü-pôn,** surnamed *De l'Eure*, French statesman: b. Neubourg, Normandy, 27 Feb. 1767; d. Rouge-Pierre, Normandy, 3 March 1855. In

1798 he was a member of the Council of the Five Hundred, which was dispersed by Murat on the 18th Brumaire. In 1811 he was nominated president of the court of justice at Rouen, and in 1813 vice-president of the corps législatif. On the restoration of the Bourbons Dupont signalized himself as a leader of the opposition. In 1830, after the revolution of July, he was made minister of justice, and after the fall of Louis Philippe became a member of the provisional government. On the accession of Napoleon III., in 1852, he ceased to take part in public affairs. Dupont was called by his political friends the "Aristides of French liberalism."

**Dupont, Pierre, pē-är,** surnamed *De l'ETANG*, French soldier: b. Chabanais 14 July 1765; d. Paris 7 March 1840. He served first with the French Legion in the Dutch service, and in 1791 in the French army. By his skilful arrangements as a staff officer, he prevented Denmark from falling into the hands of the Duke of York, and was promoted to the rank of brigadier-general. After the proceedings of the 18th Brumaire, in which he took an active part, he was appointed head of the general état-major of the army of reserve assembled at the foot of the Alps, and distinguished himself in Italy at the battle of Marengo. In 1805 he joined the army in Germany, where he freed Marshal Mortier when hemmed in by a body of Russian troops. He was also very active in the campaign of 1806 against the Prussians, and in 1807 contributed by his skilful tactics to the victory of Friedland. In 1815 he was elected member of the Chamber of Deputies by the department of Charente, and retained his seat with some interruptions till the revolution of July.

**Dupont, Pierre,** French political song writer: b. Lyons 23 April 1821; d. St. Etienne 25 July 1870. After issuing a volume of poems in 1844, he went to Paris and obtained a place in the office of the secretary of the Institute. After the revolution of February 1848 he came forward as the minstrel of socialism, and proved obnoxious to the government which came into power in December 1852. He was condemned to be banished for seven years; but the intercession of his friends soon procured his release. After that event he spent a gay and careless life by the Rhone, penning and singing his ballads one day in the mansions of the rich and the next in the cottages or workshops of the poor. His songs, which brought him fame, did not bring him fortune, and he died comparatively poor. His works (songs and music) appeared in 1854 in four volumes 8vo.

**Dupont, dü-pönt', Samuel Francis,** American naval officer: b. Bergen Point, N. J., 27 Sept. 1803; d. Philadelphia 23 June 1865. During the Mexican war, being then a commander, he saw much active and gallant service on the California coast. In 1862 he was put in command of the South Atlantic blockading squadron, and was promoted to rear-admiral in Aug. 1862. He greatly contributed to the organization of the Naval School at Annapolis, and was the author of a very remarkable report on the use of floating batteries for coast defense.

**Dupont, Victor Marie,** American manufacturer: b. Paris, France, 1 Oct. 1767; d. Philadelphia, Pa., 30 Jan. 1827. He was a son

of Pierre Samuel Dupont De Nemours (q.v.), and entered the diplomatic service as attaché to the French legation in the United States in 1787; became secretary of legation in 1795 and was appointed French consul in Charleston, S. C., in the same year. In 1798 he was appointed consul-general of France in New York. He returned to France; withdrew from the government service and came to the United States in January 1800. He entered business in New York; removed to Wilmington, Del., in 1809, where he joined his brother and established a cloth manufactory. He was for a time a member of the Delaware Legislature, and a director of the Bank of the United States.

**Du Pont de Nemours, Eleuthère Irénée**, ā-lū-thār ē-rā-nā dū-pōn dē nē-moor: b. Paris 24 June 1771; d. Philadelphia 31 Oct. 1834; son of the French political economist Pierre Samuel Du Pont de Nemours. He was a pupil of Lavoisier and entered the royal powder mills at Essonne to familiarize himself with the manufacture of gunpowder with a view to succeed Lavoisier as superintendent of the government powder mills, but subsequently abandoned this in 1791 to take charge of the printing and publishing house established by his father in Paris. Being a supporter of King Louis XVI. he was in the utmost peril after 10 Aug. 1792, and after being three times imprisoned and having his printing house sacked and destroyed he emigrated with his father's family to the United States in 1799, arriving at New London, Conn., 1 Jan. 1800. Not long after his arrival attention was called to the poor quality of gunpowder then made in this country and he determined to enter into powder manufacture here. With this in view he returned to France January 1801 to procure at Essonne, plans and models of improved machinery, returning to the United States in August with some of the machinery. Thomas Jefferson, who was deeply interested in this development, urged that the works be built in Virginia, but owing to his views regarding slavery and its effect on the white race Du Pont was unwilling to make his venture either in Virginia or Maryland. In June 1802 he bought a tract of land with a fine water-power on the Brandywine River, near Wilmington, Del. On 19 July he arrived there with his family and began operations which were so successful that, at the time of his sudden death by cholera, his works were the largest of their kind in the country. Since his death they have been carried on by his sons and grandsons and are still among the largest gunpowder works in this country, while they are the centre of the industrial combination in this industry.

**Dupont de Nemours, Pierre Samuel**, French economist: b. Paris 14 Dec. 1739; d. near Wilmington 6 Aug. 1817. He lived almost unknown in Paris as a private man of letters till 1773, when his principles of philosophy and political economy set forth in his 'Les Ephémérides du Citoyen' excited the displeasure of the minister, Choiseul, and obliged him to leave France. Several foreign princes offered him a reception and conferred honors on him. He returned, however, to his native country and accepted a small place given him by Turgot, minister of finance. In 1782 and 1783, with Dr. Hutton, the English agent, he negotiated the basis of the treaty by which the independence

of the United States of America was acknowledged. As inspector-general of commerce and manufactures, and as a councilor of state, he afterward did much to encourage French industry. After the Directory was abolished he came to the United States in 1798. In 1802 he returned to France, but did not at that time take any office, notwithstanding the offers made him by Napoleon. After Napoleon's return from Elba he settled in the United States where his two sons had already become citizens. Besides various political treatises he is likewise the author of a French translation of the first three cantos of the 'Orlando Furioso.'

**Dupont's Smokeless Powder**, a hard-grained porous powder, composed of cellulose nitrate of medium nitration which has been formed into grains by suspending the cellulose nitrate in an aqueous solution of barium and potassium nitrates to which amyl acetate is added, stirring the gelatinized material in the fluid until the grains are formed and hardening them by steam until the amyl acetate is expelled. The grains may be separated by sifting into the various desired sizes and colored to meet any taste by the addition of a very small amount of an organic coloring matter. See EXPLOSIVES; POWDER.

**Düppel**, Germany, a fortified village in the province of Schleswig-Holstein, Prussia, on the coast of the Little Belt. The place has been the scene of some severe struggles between the Danes, to whom it formerly belonged, and the Germans. In 1848 the latter were defeated here by the Danes, then the place was retaken by the Prussians, and in 1860 was again in possession of Denmark. After a long siege it was captured by the Prussians in 1864.

**Duprat, Antoine**, French statesman, archbishop, and cardinal: b. Issoire 17 Jan. 1463; d. Rambouillet 8 July 1535. Under Louis XII. he was president of the parliament of Paris, and in 1515, on the accession of Francis I., became chancellor and prime minister. The chief event of his ministry was the conclusion of the concordat, against great clerical and academic opposition, by which the Church and nobility became subject to the Crown, and by which he nullified the desire of Pope Leo X. to abrogate the Pragmatic Sanction, which in 1438 limited the spiritual power of the Pope in France, and laid the foundation of the so-called Gallican Church. In this direction he was the precursor of Richelieu and Mazarin, in the work of consolidating the power of the state. For his services, he was appointed archbishop of Sens, and later was created a cardinal.

**Dupray, Henri Louis**, òn-rē loo-ē dū-prā, French painter: b. Sedan, France, 1841. He was the pupil at Paris of Pils and Cogniet, and early directed his attention to military subjects. His 'Bataille de Waterloo' (1870) is considered his most important work.

**Dupré, Giovanni**, jō-vān nē dū-prā', Italian sculptor: b. Siena, Italy, 1 March 1817; d. Florence 10 Jan. 1882. Among his works are: 'Abel'; 'Cain'; 'Sappho'; 'Giotto'; and 'Pieta'; the last representing the dead Christ, supported by his mother.

**Dupré, Jules**, zhül dū-prā, French landscape painter: b. Nantes 5 April 1812; d. L'Isle Adam 6 Oct. 1889. He began his career as a



painter of porcelain in his father's factory, but when 18 years old went to Paris where his talent soon became recognized. He sent his first picture to the Salon in 1831; was made a chevalier of the Legion of Honor in 1849, and officer in 1870. He received a second-class medal at the Exposition of 1867 and the same at the Exposition of 1883, and a medal of honor at the Exposition of 1889. His studio for some years was in the Forest of Fontainebleau, and later in L'Isle Adam. A number of his pictures are owned in the United States.

**Dupuis, Charles François**, shärl frän-swä dü-pwē, French scholar: b. Trie-le-Château, near Gisors, 16 Oct. 1742; d. Is-sur-Tille, France, 29 Sept. 1809. In his 24th year he was made professor of rhetoric at Lisieux. His 'Mémoire sur l'Origine des Constellations et sur l'Explication de la Fable par l'Astronomie' (1781) is erudite, but rather sophistical. Later works of his are: 'Origine de tous les Cultes, ou la Religion universelle' (1794); two works on the Pelasgi, which attracted great attention; treatises on the zodiac of Denderah, and on the Phoenix; 'Mémoire explicatif du Zodiaque chronologique et mythologique' (1806).

**Dupuis, Nathan Fellowes**, Canadian scientist: b. Portland, Ontario, 13 April 1836. He was graduated at Queen's University, Kingston, in 1866, and has been a professor there for 28 years, occupying the chair first of chemistry and natural science, then of mathematics, which he still fills. He is a Fellow of the Royal Society of Canada, and editor of the Canadian 'Educational Monthly.' His published works include 'Elements of Geometrical Optics' (1868); 'Geometry of the Point, Line and Circle in the Plane' (1889); 'Elements of Synthetic Solid Geometry' (1893).

**Dupuy, dü-pwē', Eliza Ann**, American novel writer: b. Petersburg, Va., about 1814; d. New Orleans January 1881. 'The Conspirators,' her first novel, has Aaron Burr as the principal character. Most of her stories, some 40 in number, were published in the New York 'Ledger.'

**Dupuytren, Guillaume**, gē-yōm dü-pwē-trän, BARON, French surgeon and anatomist: b. Pierre-Buffière, Haute-Vienne, 6 Oct. 1777; d. Paris 8 Feb. 1835. In 1801 he obtained the situation of overseer of anatomical labors at Paris; and became in 1815 first surgeon to the Hôtel Dieu. In 1823 he was appointed first physician to the king, Louis XVIII., and retained the same situation under Charles X. He possessed extraordinary acuteness in respect of diagnosis, united with remarkable skill and dexterity in the most dangerous operations, in performing which he had a firmness of nerve which was never shaken. He invented several surgical instruments and modes of operation, and also made some discoveries in pathological anatomy. Some of his pupils united in publishing his 'Oral Lectures on Clinical Surgery' (1830-34); and his 'Theory and Practice as to the Treatment of Wounds by Warlike Weapons,' was published in 1834.

**Duquesne, dü-kän, Abraham**, French admiral: b. Dieppe 1610; d. Paris 2 Feb. 1688. In his 17th year he was in the sea-fight off Rochelle, and distinguished himself during and after the year 1637 in the war against Spain. In 1647 he

commanded the expedition against Naples. Bordeaux, which had rebelled, he reduced, notwithstanding the assistance afforded it by Spain. In the Sicilian war he thrice defeated the combined fleets of Holland and Spain, under the renowned De Ruyter, who was mortally wounded in the last engagement. After he had reduced Algiers and Genoa to the necessity of supplicating the mercy of Louis XIV., the king conferred upon him the estate of Bouchet, and made it a marquisate, with the title of Duquesne. More than this he could not do, because Duquesne was a Protestant. He was, also, the only person exempted from the banishment of his sect, occasioned by the repeal of the Edict of Nantes.

**Duquesne, dü-kän', Pa.**, borough, in Allegheny County; on the Monongahela River, and the Pennsylvania Railroad; about 10 miles from Pittsburgh. The industries, chiefly the manufacturing of steel, and iron products, are extensive. Pop. 9,300.

**Duquesnoy, François**, frän-swä dü-kä nwä, or "FRANÇOIS FLAMAND", Flemish sculptor: b. Brussels 1594; d. Leghorn, Italy, 12 July 1646. He was taught by his father and became celebrated at an early age. His best works are child figures. The Baldachino in the Vatican contains examples of his art.

**Dura Mater**, dü-ṛa mā-tēr, the outer envelope or covering of the brain. See BRAIN.

**Duram, or Durão, José de Santa Rita**, hō-sä' dā sän'tä ré'tä doo-rän', Brazilian poet: b. near Mariana, province of Minas Geraes, 1737; d. Lisbon, Portugal, 1783. He qualified himself for the service of the Church by his studies at Rio Janeiro and at Coimbra in Portugal, was graduated doctor of divinity at the university of the latter city, and joined the religious order of St. Augustine. In the course of his travels in Spain and Italy he became acquainted with Alfieri and other eminent men of letters, and subsequently during his residence at Coimbra composed a poem founded upon the story of the Galician adventurer, Diego Alvarez Correa, surnamed Caramuru, the legendary hero of Bahia. This poem was published at Lisbon in 1781, under the title of 'Caramuru, poema epico do descobrimento da Bahia,' and a French version appeared at Paris in 1829. On its first appearance the poem was not highly estimated, but since then has risen to the rank of a national epic in Brazil.

**Duramen, dü-rä'mën** (a Latin word for hardness), the heart-wood, or central wood in the trunk of exogenous trees as found in *dicotyledons* and *conifers*. (See CONIFERA.) It is hard and dense, and often dark-colored, with its tubes dry and thick. Thus in the ebony the duramen is black, and is the part used for furniture and fine cabinet-making. The alburnum (q.v.), or outer wood, is pale. In the beech the heart-wood is light brown; in the oak deep brown; in the Judas-tree yellow, and in guaiacum greenish. The relative proportion of duramen and alburnum differs in different trees. By ship-carpenters the duramen is known as the "spine."

**Duran, doo-rän', Augustin**, Spanish scholar: b. Madrid 14 Oct. 1789; d. there 1 Dec. 1862. He paid much attention to the study of foreign, especially to French literature, and edited a very important collection of Moorish, miscellaneous, and historical ballads, and ballads



## DURAN — DURANDUS

of chivalry (1828-32), a new edition forming part of the extensive *Biblioteca de autores Españoles* (Madrid 1849-51). He also wrote a history of the Spanish drama from its origin to the middle of the 18th century.

**Duran, Carolus, kâ-rô-lûs' dû-rân** (CHARLES AUGUSTE EMILE DURAND), French painter: b. Lille, 4 July 1837. He received his early art education at the municipal school in his native town, and in 1853 went to Paris and spent much time in copying again and again 'La Joconde,' at the Louvre. He gained the *Wicar* traveling scholarship, and went to Italy, and at Rome painted 'La Prière du Soir,' exhibited at the Salon in 1865. For 'L'Assassiné' (1866) he was awarded his first medal. This picture and a portrait of M. Ed. Reynart was purchased by the government for the museum at Lille. Duran resided for a year in Spain, and the influence of Velasquez is clearly seen in his 'St. Francis of Assisi,' exhibited at the Paris Salon in 1868. But his fame rests principally on his portraits, which are very numerous, and executed with a power and dash which are undeniable, whatever we may think of their refinement or grace. Among them may be mentioned Emile de Girardin, those of his daughters, the equestrian portrait of Mlle. Croizette, the well-known actress, and a portrait of Pasteur. He is a Chevalier of the Legion of Honor, and of the Order of Leopold. In 1898 he made a lecturing tour to the United States, this being his second visit. In the same year he was elected president of the National Society of Fine Arts.

**Durance, dû-râns**, a river in France, which rises in Mount Genève, on the west slope of the Cottian Alps; flows in a general direction south, and, after a course of 180 miles, empties into the Rhone, 4 miles below Avignon. The stream is so full of debris that it is not navigable. It often commits great ravages by inundation.

**Durand, dû-rân, Alice Mary Céleste Fleury** ("HENRY GRÉVILLE"), French novelist: b. Paris 12 Oct. 1842; d. there 26 May 1902. In early life she went to St. Petersburg with her father, Professor Fleury. She there married M. Durand, a French law professor, returning to France in 1872. She visited the United States in 1886 and several of her novels re-published in America, had a wide circulation here. Her published works, appearing under the pseudonym, "HENRY GRÉVILLE," include: 'A Travers Champs' (1812); 'Dosia' (1876); 'L'Expiation de Savelli' (1876); 'La Princesse Oghéroff' (1876); 'Les Koumiassine' (1877); 'Suzanne Normis' (1877); 'Sonia' (1877); 'La Maison Maurège' (1877); 'Les Epreuves de Raissa' (1877); 'L'Amie' (1878); 'Un violon russe' (1879); 'Lucie Rodéy' (1879); 'Le Moulin Frappier' (1880); 'La cité Ménard' (1880); 'Madame de Dreux' (1881); 'Rose Rozier' (1882); 'Manuel d'Instruction Civique et Morale des Jeunes Filles' (1882); 'Un Crime' (1884); 'Idylles' (1885); 'Cléopâtre' (1886); 'Frankley' (1880); 'L'avenir d'Aliné' (1889); 'Chant de Noces' (1889); 'Le Passe' (1890); 'Un Mystère' (1890); 'Aurette' (1891); 'Péril' (1891); 'L'Héritière' (1891); 'Un vieux menage' (1893); 'Fidelka' (1894); etc.

**Durand, dû-rând', Asher Brown**, American painter and engraver: b. South Orange, N. J., 21 Aug. 1796; d. there 17 Sept. 1886. For a long time his employment consisted in copying prints

from English books, and working on plates for bank-notes. His engraving of Trumbull's 'Declaration of Independence' brought him into general notice, and thenceforth for many years his graver was in constant demand for portraits of various dimensions, and figure pieces. He had always, however, entertained the idea of ultimately becoming a painter, and in 1835, having for the previous 10 years been a regular contributor of portraits, small figure pieces, or landscapes in oil, to the exhibitions of the National Academy of Design, finally abandoned engraving as a profession. He devoted himself thereafter mainly to landscape painting, in which department of art he became eminent. The Corcoran Art Gallery, at Washington, contains his 'Mountain Forest' (1869).

**Durand, William Frederick**, American engineer: b. Bethany, Conn., 5 March 1859. He was graduated at Annapolis, 1880; served in the United States Naval Engineer Corps (1880-7); was professor of mechanical engineering in the Michigan Agricultural and Mechanical College (1887-91), when he became associate professor of marine engineering at Cornell, and full professor in 1895. He has also been principal of the Graduate School of Marine Engineering and Naval Architecture since 1891. He has published 'Resistance and Propulsion of Ships' (1898); 'Practical Marine Engineering' (1902); and many special articles in engineering journals.

**Durand, Wis.**, city, county-seat of Pepin County; on the Chippewa River, about 20 miles from its junction with the Mississippi, and on the Chicago, M. & St. P. R.R. It is the centre of an agricultural region, and its trade and industries are those that pertain to agriculture and stock-raising. Pop. (1900) 1,458.

**Durando, doo-rân'dô, Giacomo**, Italian general: b. Mondovì, Italy, 1807; d. Rome 26 Aug. 1894. He was minister of war at Turin 1854-5; became a senator in 1860; was minister of foreign affairs in the cabinet of Ratazzi 1862-3, and president of the senate 1884-7. He published in 1847 a brochure in favor of Italian unity under a constitutional government.

**Durandus, dû-rân'dus, Gulielmus**, French prelate and jurist: b. Puimisson, Languedoc 1237; d. Rome 1 Nov. 1296. He became professor of the canon law in the University of Modena, and there acquired so high a reputation for his learning that Pope Clement IV. made him auditor of the Sacred Palace, and took him as his secretary to the General Council of Lyons (1274). He continued to hold high office in the Curia under successive popes till 1277, when he was appointed lieutenant-governor, both in temporal and spiritual affairs, of the patrimony of St. Peter, under Nicholas III.; the following year he successfully asserted the sovereignty of the Pope over the provinces of Bologna and Romagna. These two provinces he then governed from 1283 to 1286, in the meantime carrying on a war against the people of Romagna, who were in revolt. He was appointed bishop of Meude in Languedoc in the latter year, and retired from the governorship. In 1295 he was again in public station, governor of Romagna, and the March of Ancona; but his strength was unequal to the task of resisting the attacks of the Ghibelline faction, and he resigned his office. His greatest work, 'Speculum Juris' (mirror of the law),

## DURANGO—DURAZNO

called by himself ('Speculum Judiciale,' was for a long time a work of highest authority in the practice of both departments of the law; between the years 1474 and 1678 it had 38 editions. He wrote an informal history (commentarius) of the General Council of Lyons, the decrees of which were drawn up by him. Many other works he wrote, which have not been printed.

**Durango**, dü-răn'gō, Colo., town, county-seat of La Plata County; on the Las Animas River, the Denver & R. G., and the Rio Grande S. railroads; about 20 miles north of the boundary line between Colorado and New Mexico. The smelting and reduction works are the chief manufactories of the town. It has also flour-mills and foundries, and it is the trade centre for the agricultural, stock-raising, and mining products of the southwestern part of Colorado. Pop. 3,500.

**Durango**, doo-răn'gō, Mexico, a state bounded by Chihuahua on the north, Coahuila on the east and southeast, Zacatecas and Tepic on the south, and Sinaloa on the west. It is one of the largest and richest states in the republic. The Sierra Madre range (altitude 8,125 feet to 11,375 feet) traverses the western and southern portions. Less important ranges are the Copolquina, Topia, Cavelas, Amacuti, Tominil, Muinora, Guanacoi, and San Juan de Camarones; these, as well as the isolated peaks, Cerro del Mercado, Pánuco de Avino, etc., are ore-bearing. The Cerro del Fraile is an extinct volcano. Among the rivers, the Nazas, in the northern part of the state, with its affluents, the Santiago and San Juan; the Tunal, which rises west of the city of Durango, and its affluent, the Suchil; the Rio Chico, or Alaponeta, and the Aguanaval, may be mentioned. There are small lakes, mineral springs, etc. Gold, copper, and silver are the chief mineral products, and the best mining districts are in the partidos of San Dimas, Tamazula, Papasquiario, San Juan del Rio, Durango, and Nombredelos Dios. On 31 Dec. 1897 there were, according to Mexican official figures, 1,331 mining claims registered in Durango. The Cerro del Mercado, near Durango city, is said to contain an immense deposit of iron. Sulphur and rubies are also found. The climate varies with the altitude of the different localities, being cool or cold in the mountainous western regions, and temperate, or warm, in the valleys extending from the base of the mountains and in the Nazas basin. The pasture lands are extremely hot in summer and cold in winter. There is a moderate rainfall, and frosts occur frequently in the uplands. The best agricultural regions are in the partidos of Mapimi, Durango, San Juan del Rio, and Papasquiario; the agricultural products being corn, barley, wheat, cotton, tobacco, fruits, and sugarcane. The value of the barley produced in a year (Mexican official statistics for 1897) is \$19,310; cotton \$5,403,373; wheat \$602,320; sugarcane products \$11,908, etc. Stock-raising sections are the partidos of El Oro, Cuencamé, Durango, Mazas, Indé, and Papasquiario. Commercial centres are the partidos of Durango and Mapimi an active trade being maintained with the neighboring Mexican states, the United States, and Mexico city. Gold, silver, and iron ores, cereals, cotton, cotton and woolen goods, woods, fruits, live-stock, hides, etc., are exported. The principal imports are groceries, hardware, silk, cotton, linen goods, machinery, agricultural

implements, mining tools, arms and ammunition. The trade of the state has an estimated annual value of \$10,000,000. Manufactured products are: Leather, flour, ixtle carpets, rope, pottery, soap and candles, cotton goods, etc. The railroads are the Mexican International, and the Central. The cities of Durango and Villa Lerdo have street-car systems. There are 186 miles of telegraph, and 310 miles of telephone wires, and an efficient mail service. The state is divided into 13 partidos—Tamazula, pop. 24,305; Papasquiario, 32,410; Indé, 13,532; Mapimi, 42,548; chief town, Villa Lerdo, with steam flour-mills, a foundry, and other industrial establishments; Cuencamé, 22,940; San Juan de Guadalupe, 10,605; Nombredelos Dios, 23,090; Mezquitlan, 6,930; Durango, 60,427, chief town (also capital of the state) Durango (q.v.); San Dimas, 6,480; El Oro, 15,899; Nazas, 19,395; and San Juan del Rio, 25,573. Pop. of the state 295,105.

**Durango Guadiana**, or **Ciudad de Victoria**, Mexico, capital of the state of the same name, 569 miles from Mexico city. It has many fine buildings, notably the cathedral, government palace, city hall, the theatre, and the mint. There are cotton- and woolen-mills, foundries, flour- and sugar-mills, two banks, a street-car system, and a railroad to Ciudad Porfirio Diaz. Pop. 26,425.

**Durant**, Henry Fowle, American philanthropist: b. Hanover, N. H., 20 Feb. 1822; d. Wellesley, Mass., 3 Oct. 1881. He was graduated from Harvard in 1842 and became a lawyer, changing his name from Henry Welles Smith to H. T. Durant. He practised with great success at the bar, but on the death of his only son abandoned his profession and devoted his energies to philanthropy. He founded Wellesley College (q.v.), opened in 1875, and was successful as a lay preacher.

**Durante**, Francesco, frän-chës'ko doo-răn'të, Italian musician: b. Naples 15 March 1684; d. there 13 Aug. 1755. He is deemed one of the founders of the "Neapolitan school" of composition, and is especially celebrated as a teacher.

**Duras**, Claire Lechat de Kersaint, klär lê-shâ dê ker-sân dü-râ, DUCHESS OF, French novelist: b. Brest 1777; d. Paris 1828. She wrote 'Ourika' (1823), and 'Edward' (1825).

**Durazno**, doo-räs'nō, Uruguay, a department bounded on the north by Tacuarembó, southeast by Cerro Largo and Treinta y Tres, on the south by Florida and Flores, and on the west by Flores and Rio Negro. It is the most central of the departments, and in size the third. Area, 5,527 square miles. A range of hills divides it into two sections or basins, of which one extends northward to the Rio Negro, and the other southward to the Yi River, the department lying between these two rivers. Numerous streams, rising in the central chain of hills, flow toward the south or north; the entire surface is, therefore, well watered, and furnishes grazing for a large number of cattle, sheep, horses, and mules. Pop. about 25,000.

**Durazno**, Uruguay, capital of the department of Durazno. It is situated near the Yi River, and is one of the principal stations on the Central Uruguay Railroad. As an active centre for the trading of the neighborhood, it has substantial buildings, a church, hotels, and shops. Pop. 2,000.

## DURAZZO — DÜRER

**Durazzo**, doo-rät'sō (ancient DYRRHACHIUM or EPIDAMNUS), Turkey, a seaport, in the province of Albania, on the Adriatic, 50 miles south by west of Scutari. It was originally founded by a colony of Greeks from Corcyra, and was long the most important maritime town of Illyria. A few columns and marbles are now almost the only remains of the ancient city; the modern town is a poor place of about 1,200 inhabitants.

**Durban**, dër'băn, Natal, town, the only seaport of Natal; situated on the northern shore of the land-locked inlet known as Port Natal. It is well laid out and solidly built, and has a number of fine buildings. There are railroad connections with the capital and other places. On the "Bluff" at the entrance to the port a battery of heavy guns has been placed. Durban was founded in 1834, and named after Sir Benjamin D'Urban, for some time governor of Cape Colony. Pop. 25,512.

**Durbar**, dër'bār (Hind. and Pers., *darbar*, door of admittance), in India, Afghanistan, and Persia a state audience at which important public hearings are given, decrees or decisions announced, distinguished foreign visitors received, and treaties, etc., made. These functions are often of great splendor and under British rule there have been several famous durbars in India. The first after the downfall of the Mogul empire and the Mutiny was held 1 Nov. 1858 at Allahabad. Lord Canning then announced the sovereignty of Queen Victoria, and offered amnesty to all but actual murderers of the English. Each viceroy since has held them to impress the Hindus. One of the most magnificent was held by Lord Lytton in 1877, when Queen Victoria took the title of empress of India. The then Prince of Wales had just been visiting India, and been received with enthusiastic demonstrations, and the viceroy summoned the feudatory rulers and their retinues to a great durbar at Delhi, where the proclamation of the new title was made, and festivities, including a grand ball, games, parades, fireworks, convocation of the Indian orders, etc., were held. Another of great splendor was given at the same city on 1 Jan. 1903, to proclaim the accession of Edward VII. The name "durbar" is used also for the audience chamber, as we speak of a church (building).

**Durbin**, dër'bîn, **John Price**, American Methodist clergyman and miscellaneous writer: b. Bourbon County, Ky., 1800; d. New York 17 Oct. 1876. He contributed extensively to current literature, and was the author of 'Observations in Europe, Principally in France and Great Britain' (1844); and 'Observations in Egypt, Palestine, Syria, and Asia Minor' (1845).

**Düren** (ancient MARCUDURUM), Germany, town in Rhenish Prussia, on the Roer and the railroad from Aix-la-Chapelle to Cologne, 16 miles east by north of Aix-la-Chapelle. It is of Roman origin, and is mentioned under its ancient name by Tacitus. In 1543 it was destroyed by the Emperor Charles V., at the head of 50,000 men. Diets were held here by Charlemagne (775 and 779). The modern town has some handsome churches, a gymnasium, important manufactures of woollens, paper, leather, and hardware; several large distilleries, and an extensive trade. Pop. (1900) 27,171.

**Dürer**, Albrecht, äl'breht dü'rër, German painter: b. Nuremberg, Bavaria, 21 May 1471; d. there 1528. His father was a skilful goldsmith of Hungary, and himself instructed his son. Dürer's talent early developed itself, and although he had made great progress in his father's profession by the time he was 15, his inclination took a decided turn for painting. Michael Wohlgemuth, then the best painter in Nuremberg, became his instructor in 1486. Having finished his studies he entered upon his travels, returning home in 1494. Here he executed his masterpiece, a drawing of Orpheus. To please his father he married the daughter of Hans Frey, a celebrated mechanic; but this connection embittered his life, and perhaps brought him to an early grave. In 1505 he went to Venice to accomplish himself in his art. His abilities excited envy and admiration. He painted the 'Martyrdom of Bartholomew' for St. Mark's Church, which painting was purchased by the Emperor Rodolph, and removed to Prague. He also traveled to Bologna, to improve his knowledge of perspective. At his return, in 1507, begins the proper era of his greatness. His fame spread far and wide. Maximilian I. appointed him his court-painter, and Charles V. confirmed him in this office, bestowing upon him at the same time the painter's coat of arms, namely, three escutcheons argent in a deep azure field. Dürer was in favor with high and low. All the artists and learned men of his time honored and loved him, and his early death was greatly lamented. Profound application, great facility in the mechanical part of his art, and a remarkable talent of imitation, were the characteristics of Dürer, and enabled him to exert a great influence on the character of German art. He was the first in Germany who taught the rules of perspective, and of the proportions of the human body, according to mathematical principles. His treatise on proportions was occasioned, it is said, by his studies on the picture of 'Adam and Eve.' He not only made use of the burin, like his predecessors, but was also the inventor of etching, or, if not the inventor, the first who excelled in the art. He invented the method of printing wood-cuts with two colors. His great mathematical knowledge enabled him to form a regular system of rules for drawing and painting. He wrote the first book on fortification, in Germany, and showed how to cast the letters of the alphabet according to fixed proportions, by geometrical calculations. He was particularly eminent as a portrait painter. He had the power of catching the exact expression of the features, and of delineating all the passions. Among his best engravings in copper are his 'Fortune'; 'Melancholy'; 'Adam and Eve in Paradise'; 'St. Hubert'; 'St. Jerome'; and the 'Smaller Passion' (so-called) in 16 plates. Among his best wood-cuts are the 'Greater Passion' (so-called) in 13 plates; the 'Smaller Passion,' with the frontispiece, 37 pieces; the 'Revelation of St. John,' with the frontispiece, 15 plates; the 'Life of Mary,' two prints, with the frontispiece. Bartsch, however, has made it more than probable that Dürer himself did not engrave in wood. He only made the drawings on wooden tablets, which were then cut by form-cutters, of whom there were many skilful ones at that time. Dürer has also much merit as a writer. His writings, which were afterward translated into Latin, French,

etc., were published in a collected form at Arnheim (1603). See Scott, 'Albert Dürer, His Life and Works' (1869); Heaton, 'History of the Life of Albert Dürer' (1869); Thausing, 'Dürer, Geschichte seines Lebens und seiner Kunst'; Colvin, 'Albrecht Dürer, His Teachers, His Rivals, and His Scholars' (1877); Ephrussi, 'Albrecht Dürer et son dessein' (1882); Springer, 'Albrecht Dürer' (1892); Cust, 'Albrecht Dürer' (1897).

**Duress**, *dū'rēs* or *dū-rēs'* (Ital. *duressa*, Lat. *duritia*, deriv. of *durus*, hard), restraint of liberty, or restraint of the person or goods. (1) Of the person. This is exercised either by incarceration or by threats or menaces, *duress per minas*; in either case the overt act must consist in compelling a person to do some act, as to execute a deed or commit an offense; in such cases the act is invalid and excusable. In a broader sense, duress is charged by the law when a person in extreme poverty or distress is induced to seek alleviation by assuming an obligation. Yet the deed signed, or the contract made under duress is not void, though voidable at the will of the party compelled to execute or assume it. (2) Duress of goods refers to the case of one who is compelled to pay money for the release of goods unlawfully detained. Duress may be charged to the collector of a port who charges unauthorized duties.

**Duret, Francisque**, *frän-sësk dü-rä*, French sculptor: b. Paris 19 Oct. 1804; d. there 25 May 1865. He studied sculpture in Paris with intense ardor; in 1823 he won the Roman prize, and gained a gold medal in 1831 by his 'Mercury, Inventor of the Lyre,' which recalled somewhat the refined modernity of Canova. Indeed, Canova seems to have been rather the source of inspiration to him than the models of the antique. In 1833 he produced 'The Neapolitan Fisherman Dancing the Tarantula,' a work of life-like realism, of perfect elegance and the most refined modeling, which is his masterpiece, and stands in the Louvre. In the same gallery is his 'Improvisator Singing a Love-Song' (1836), a replica of which is in the city museum of Leipsic. For the museum at Versailles he executed statues of Molière, Dunois, and Richelieu; for the Madeleine figures of Christ and St. Gabriel. The gallery of seven chimneys in the Louvre is adorned by his 'Victory,' and for the foyer of the Théâtre Française he executed statues of 'Tragedy' and 'Comedy' and a figure of Rachel, the actress. In 1860 he completed the monumental fountain on the Place de St. Michel, in Paris. It is surmounted by a figure of 'St. Michael the Dragon-Slayer.' As professor in the Ecole des Beaux Arts, his energies were concentrated on the task of teaching and he produced few original works; those which he has left are good examples of modern French sculpture with its ease, its demonstrative fluidity and dramatic point, which take the place of the serenity and severe but flawless grace of the Greek masters.

**Durfee, dër'fë, Job**, American jurist: b. Tiverton, R. I., 20 Sept. 1790; d. there 26 July 1847. He was graduated at Brown University in 1813; was elected to Congress in 1820, and became chief justice of Rhode Island in 1835. Among his various writings is 'What Cheer,' a poem on the adventures of Roger Williams.

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**Durfee, Thomas**, American jurist: b. Tiverton, R. I., 6 Feb. 1826; d. Providence, R. I., 6 June 1901. He was graduated at Brown University 1846; was admitted to the bar 1848; reporter of the Rhode Island supreme court 1849-53; presiding judge of the court of magistrates 1855-60; speaker of the Rhode Island house of representatives 1863-5; associate justice of the Rhode Island supreme court 1865-75; and chief justice 1875-91, when he retired. He was elected a trustee of Brown University 1875, and its chancellor 1879-88. He published: 'Reports of Cases in the Supreme Court of Rhode Island' (1851-3); 'Treatise on the Law of Highways' (1857), begun by J. K. Angell; 'The Village Picnic, and Other Poems' (1872); 'Gleanings from the Judicial History of Rhode Island' (1883); 'Some Thoughts on the Constitution of Rhode Island' (1884); and several orations on public occasions.

**Durfee, William Franklin**, American engineer: b. New Bedford, Mass., 15 Nov. 1833; d. Middletown, N. Y., 14 Nov. 1899. He studied at Lawrence Scientific School, Harvard, and turned his attention to steel manufacture, his establishment turning out in 1865 the ingots from which were made the first steel rails in the United States. After 1875 he practised as a consulting engineer and patent expert.

**D'Urfey, dër'fi, Thomas**, commonly known as "Tom D'URFEY," English dramatist and poet: b. Exeter, 1653; d. London 26 Feb. 1723. He was a good-natured, simple-hearted, thoroughly vulgar and unliterary writer. His dramas, comedies, operas, tragedies, and songs are exactly like what Sancho Panza would have written if he had taken to letters. Many, like 'The Siege of Memphis' (1676), an extravagant tragedy, and 'The Plotting Sisters' (1691), a comedy, are verbose; others, like the 'Songs Complete' (1699), are of virginal simplicity, but not of virginal modesty.

**Durga, door'gä** (Sanskrit, "The Inaccessible One"), a Hindu divinity, one of the names given to the consort of Siva. She is generally represented with 10 arms. In one hand she holds a spear, with which she is piercing Mahisha, the chief of the demons, the killing of whom was her most famous exploit; in another a sword; in a third the hair of the demon chief; and in others, the trident, discus, axe, club, and shield. A great festival in her honor, the *Durgapuja*, is celebrated annually in Bengal with wild orgies about the beginning of October, and lasts for about 10 days in all. See SIVA, DEVI.

**Durgah, The**, a famous tomb built for the Sheikh Selim-Chisti, at Futtehpore, near Agra, in Hindustan. It was erected at a cost of 37 lacs of rupees, or \$1,750,000. The tomb as well as a canopy, six feet high, which covers it, is made of mother-of-pearl. The floor is of jasper and the walls of white marble inlaid with cornelian. The screens of marble surrounding the building are the most beautiful in India. They are single, thin slabs about eight feet square and wrought into such intricate open patterns that they appear as having been woven in a loom.

**Durham, dūr'am, John George Lambton**, EARL OF, English statesman: b. London 12 April 1792; d. Cowes, Isle of Wight, 28 July 1840. He took an active part in furthering all projects of a reforming tendency, even bringing

forward in 1821 a scheme for parliamentary reform much more advanced than that of 1832. In 1828 he was raised to the peerage, with the title of Baron Durham. Under the administration of Lord Grey (1830) he held the office of Lord Privy Seal, and was one of the four persons who drew up the Reform Bill, and supported it in the House of Lords. For a time he was ambassador at St. Petersburg. In 1838 he was appointed governor-general of Canada, where owing to the revolt of the French in Lower Canada, the constitution had been suspended. Lord Durham's measures were statesmanlike, but dictatorial; and the House of Lords voted disapproval of some of his acts. Thereupon he took the extraordinary step of returning to England without either being recalled or obtaining the royal consent. Lord Durham's famous report on Canada anticipated many of the best features in the present Canadian constitution.

**Durham**, one of the three English counties called counties palatine (see COUNTY PALATINE). There is more coal mined in Durham than in any other county of England; and lead and iron mines are worked. Some of its manufactures are iron works, potteries, linen- and woolen-mills, glass and chemical works. Pop. (1901) 1,187,324.

**Durham** (ancient DUNHOLME), England, city and parliamentary borough, capital of the county of the same name, on the River Wear; 14 miles south of Newcastle. The principal public buildings are the ancient castle (now appropriated to the uses of the university), the cathedral, and other churches, the town hall, county prison, and the grammar school. The educational institutions comprise the university, the grammar school, training school for school-mistresses, and other schools. There are manufactures of carpeting and mustard. The cathedral is believed to have been founded by William de Carilepho, assisted by Malcolm, king of Scotland, in 1093. Pop. 14,935.

**Durham**, N. C., city in Durham County, on the Southern Air Line and the Southern railroads; 26 miles northwest of Raleigh. It is a tobacco and cotton-growing centre, and the seat of Trinity College (Methodist Episcopal South). The manufacture of a famous brand of smoking tobacco is the staple industry of the place. It was the scene of the treaty between Gens. Sherman and Johnston at the close of the Civil War. It has a national bank, newspapers, and good schools. Pop. 6,679.

**Durham Book**, *The*, or *St. Cuthbert's Book*, a manuscript of the Latin text of the gospels, with an interlinear gloss in Saxon. The book dates from the last of the 7th century, and is supposed by some to have been written by Eadfrith, of Lindisfarne. It is one of the most beautiful of the manuscripts made by the old monks, and is one of the most highly prized treasures of the British Museum.

**Durham Cattle**. See CATTLE.

**Durham, University of**, located at Durham and which was originated in 1831 under Bishop Van Mildert, by the appropriation of part of the property belonging to the cathedral chapter. In 1832 an act of Parliament was obtained sanctioning the erection of the proposed university; in 1833 the university was opened, and in 1837

it was incorporated by royal charter. In 1841 the office of warden was permanently annexed to the deanery of Durham, a canonry in the cathedral was annexed to each of the professors of divinity and Greek; a professor of mathematics and astronomy appointed, and 18 fellowships were founded, besides 6 which had previously been founded by the dean and chapter. As at Oxford and Cambridge, the students reside mostly within the university buildings, accommodation being provided for them in University College, and in Bishop Hatfield's Hall. The university awards the degrees of Bachelor and Master of Arts, Bachelor and Doctor of Literature, of Science, and of Divinity; the usual medical degrees, degrees in music, and the degree of Doctor of Civil Law. The academical year is divided into three terms—Michaelmas, Epiphany, and Easter. No religious test is required from any member of the university unless he is a student in the faculty of theology. Science was taught from the first, but not to a satisfactory extent till 1871, when the Durham College of Science was instituted in connection with the university at Newcastle-upon-Tyne. The medical department of the university is constituted by the Durham University College of Medicine, founded in 1851 at Newcastle, an institution which has greatly increased in efficiency in recent years by the establishment of additional chairs. Since 1895 all degrees except those in divinity may be granted to women.

**Durian**, dū'ri-ān, or **Durion** (*Durio zibethinus*), a fruit-tree of the natural order *Malvaceae*, generally diffused over the southeast of Asia, especially in the Malay peninsula and neighboring islands. It is esteemed for the flavor of its fruit which, however, is an acquired taste, the fruit having a strong, musk-like odor, and a somewhat terebinthine flavor. The tree, which on an average yields 200 fruits annually, is about the size and the form of a pear-tree, but with cherry-shaped leaves, except that they are entire and smooth at the edges. The flowers are large and of a yellowish-white. The fruit, of globular or oval form, from eight to ten inches long, large in some species as a man's head, is not unlike the bread-fruit externally. It has a hard, prickly rind, covered with warts and tubercles. When ripe it becomes of a brownish-yellow, and opens at the top; it must be eaten almost fresh from the tree, as it putrefies in less than 24 hours. The fruit contains five large longitudinal cells, each containing one to four seeds about the size of pigeon's eggs, embedded in a custard-like pulp, which is the delicious part of the fruit. The seeds are roasted and eaten like chestnuts, ground into flour, and also made into vegetable ivory. The pharmaceutical qualities of the fruit are aphrodisiacal.

**Dürkheim**, dürk'hīm, or **Dürkheim an der Hardt**, Bavaria, town in the Palatinate, 14 miles southwest of Mannheim. Its annual sausage market, founded in 1494, is attended by large numbers of people. Dürkheim has saline springs, in the water of which Bunsen and Kirchhoff, by spectrum analysis, first detected the metals rubidium and caesium in 1860. Dürkheim was walled and fortified, so was an object of keen contest during the Thirty Years' War. Pop. 6,055.

**Durlach**, door'lāh, Germany, town in the Grand Duchy of Baden, four miles southeast



of Carlsruhe, at the foot of the Turmberg. It is of Roman origin. It has manufactures of iron, machinery, organs, sewing-machines, gloves and beer, and is celebrated for its fruit. Pop. 11,425.

**Durmast**, dër'mast, a species of oak, *Quercus scssiliflora*, or according to some *Q. pubescens*, a variety of the common oak (*Q. robur*). Its wood is, however, darker, heavier, less easy to split, not so easy to break, yet the least difficult to bend. It is highly valued, therefore, by the builder and cabinet-maker.

**Duroc**, Michel Gérard Christophe, mē-shēl zhā-rār krēs-tōf dü-rōk, Duke of Friuli, French soldier: b. Pont-à-Mousson, 25 Oct. 1772; d. Bautzen 22 May 1813. He served as aide-de-camp to Napoleon in the Italian and Egyptian campaigns. In 1805 he was made grand marshal of the palace, and was frequently employed in diplomatic missions, though he still took his full share in the wars of France till the time of his death. He was a great favorite of Napoleon, and was killed by his side at the battle of Bautzen.

**Durra**, dūr-ā, a genus of grasses of great economical importance throughout Africa and Asia, especially in India, also called Indian millet, Guinea corn, or Sorgho grass. See SORGHUM.

**Dürrenstein**, dūr'rēn-stīn, Austria, village on the Danube; 41 miles northwest of Vienna. It is celebrated for its feudal castle, in which Richard Cœur-de-Lion was treacherously detained on his return from Palestine (1192) by Duke Leopold of Austria. It was destroyed by the Swedes in 1645. In November, 1805, the French here defeated the Austrians and Russians.

**Durugmunan**, doo-roog-moo'nān, a race possessing Mongolian characteristics and dwelling in the interior of the island of Mindoro.

**Duruy, Georges**, zhōrzh dü-rü-ē, French writer on history: b. Paris 1853. He became professor of French literature in the Polytechnic School in 1891. He wrote some novels that became popular favorites, as 'The Life-guard'; 'A Soul's Victory'; 'Dream-End.' His principal historical works are: 'History of Turenne'; 'Short Popular History of France.' His 'Cardinal Carlo Carafa: a Study on the Pontificate of Paul IV.' (1883) was crowned by the Academy.

**Duruy, Victor**, vək-tōr, French historian and statesman: b. Paris 11 Sept. 1811; d. there 25 Nov. 1894. He was professor of history in the Collège (afterward Lycée) Henry IV. prior to 1861. In 1862 he was appointed inspector-general of public instruction and professor at the École Polytechnique, and in the following year Napoleon III. made him minister of public instruction. During his six years' tenure of this office he carried out many important reforms in spite of the determined opposition of the clerical party, and on resigning his office in 1869 he was nominated a member of the senate. He was elected a member of the Academy of Inscriptions in 1873, and in 1884 a member of the French Academy. Besides many excellent school manuals, he wrote: 'Histoire des Romains depuis les Temps les plus Reculés jusqu'à L'Invasion des Barbares' (1870-9), his most important work; 'Histoire des Grecs depuis les

Temps les plus Reculés jusqu'à la Réduction de la Grèce en Province Romaine' (1862), crowned by the Academy; 'Histoire de France' (1852); 'Introduction Générale à l'Histoire de France' (1865); and other works. He was general editor of Hachette's great 'Histoire Universelle.'

**Durward, Quentin**. See QUENTIN DURWARD.

**Duryée**, dūr-yā, Abram, American soldier: b. New York 1815; d. there 1890. He was educated in the common schools, and going into business made his fortune in mahogany furniture. He entered the State militia in 1833, was made colonel of the 27th Regiment in 1849 and was conspicuous as a maintainer of order during the riots that prevailed up to 1861. During the Civil War he raised the regiment known as 'Duryée's Zouaves,' and was promoted to be brigadier-general of volunteers in August 1861, but resigned in January 1863 owing to a disagreement over a question of rank. His gallant services at the battles of Cedar Mountain, Rappahannock Station, Thoroughfare Gap, Groveton, Chantilly, South Mountain, and Antietam gained for him the brevet rank of major-general in 1865. In 1874, as police commissioner of New York, he attacked and dispersed a body of communists seditiously gathered together in Tompkins Square.

**Duse**, doo'sā, Eleanora, Italian actress: b. Vigevano, Italy, 3 Oct. 1859. Her childhood and early youth were filled with sorrow, arising from poverty, hardships, the loss of friends and an unworthily bestowed affection. Hers was a lineage of actors, and her early environment destined her for the stage. Her grandfather founded the Garibaldi Theatre in Padua. She was dragged about the minor theatres of Italy in her father's companies, playing Cosette in 'Les Misérables' at 7, and star of the little troop at 13 in 'Francesca da Rimini.' When she was 14 she played Juliet at Verona, in an open-air theatre, her performance compelling recognition as most extraordinarily brilliant. Still she had to wait for general recognition until 1879, when she played Zola's 'Thérèse Raquin' in Naples in 1887. She appeared in Venice in 1892, and later in all the chief European cities, making her debut at the Fifth Avenue Theatre in New York as Camille in Dumas' play of that name, January 1893. Among the roles which she has triumphantly essayed are Marguerite, Magda, Paula, La Femme de Claude, La Locandiera. She was married to an Italian actor-journalist, Signor Checchi, before she was 20, but they soon separated. Duse has remarkable emotional power and the ability to represent suffering and to make the most of tragic situations, at the same time possessing such versatility that she can play parts of opposite character the same evening. She pays little attention to the meretricious accessories of the stage makeup. Great simplicity and naturalness, coupled with striking intensity, characterize her acting. She has great excellence in diction and in facial expression, the latter being continuous and minute. Her repertory is enormous, her art including the plays of Dumas, Scribe, Verga, Prega, Ibsen, Sudermann, d'Annunzio, and Shakespeare. Her tours in the United States, 1893, 1896, 1902-3, were very successful from the artistic and managerial point of view.



## DUSKY DUCK — DUST

**Dusky Duck, or Black Duck**, a north American duck (*Anas obscura*), closely related to the mallard, but of a prevailing sooty hue in its plumage. It is peculiar in being confined to the eastern half of North America, breeding abundantly in Labrador, and appearing in the United States in winter, when it becomes one of the principal market ducks. Its nest, eggs, and general habits are like those of the mallard.

**Dussaud, dūs-sō, Frantz**, Swiss physicist and inventor: b. Geneva, Switzerland, 1870. He was appointed professor of physics in the university of his native town in 1892 and superintendent of public instruction in 1895, in which year he was elected deputy to the assembly. Besides his services as a scientific writer, he has invented many ingenious and useful appliances such as the phonograph for the deaf, the cinematograph for the blind, the loud-speaking telephone, the registering telephone, etc.

**Dussek, Jan Ladislav**, yān lād'is-lā doo'-shék, Bohemian composer and pianist: b. Czeslau 9 Feb. 1761; d. St. Germain-en-Laye 20 March 1812. He was trained at Iglau, Kuttenberg, and Prague, and afterward was organist at Mechlin and Bergenop-Zoom. At Amsterdam he met with much success, both as a teacher and performer, and here he produced his earliest works for the pianoforte; he afterward resided at The Hague, and in Hamburg, Lithuania, Paris, Milan, and London (1788-1800), where he was very popular. In 1803-6 he lived as instructor and boon companion with Prince Louis Ferdinand of Prussia, whose death called forth the beautiful and pathetic 'Elégie Harmonique' (op. 61); in 1807 he entered the service of Prince Talleyrand, and thenceforward devoted most of his time to composition.

**Düsseldorf, dūs'sel-dōrf**, Germany, city, the capital of the government of the same name, in the Rhenish province; on the Rhine, here crossed by a bridge of boats, and on the railroad from Elberfeld, 22 miles northwest of Cologne. It consists of the old town in the north, Karlstadt, the new town, and Friedrichstadt in the south, with the suburbs of Derendorf, Flingern, Oberbilk, Unterbilk, and other small places. The chief public squares are the Corneliusplatz, with a fountain and a statue of Cornelius; Schadowplatz, with a monument of Schadow; the market-place with an equestrian statue of the Elector Johann Wilhelm; and the Burgplatz, with the tower of the castle which was founded in 1710 and burned down in 1872. In 1896 a bronze equestrian statue of the Emperor William I. was unveiled. The principal churches, of which there are 12 Roman Catholic and 3 Protestant, are St. Lambert's, a 14th century building, near the Rhine, adorned with marble monuments of Wilhelm IV. and Johann Wilhelm, the last two Dukes of Cleves and Berg; and St. Andrew's, completed 1629. Other buildings are the Academy, a modern building in the Renaissance style; the court-house, with Schadow's last oil-paintings; and a building of the 16th century, with fine paintings. The Academy of Art was founded 1767, by the Elector Theodore, remodelled in 1821, and afterwards directed by Cornelius and Schadow. This city has the honor of having founded a school of painting, which takes the name of Düsseldorf. In the Art Hall, opened in 1881, are several modern pictures; and there are some paintings by the

old masters, besides drawings, engravings, and water-colors, in the old palace. The Hofgarten is a magnificent public garden extending eastward from the Rhine; and there are also a zoological garden and a Floragarten. Düsseldorf carries on considerable manufacturing, and its trade as a port and railroad centre is large and increasing. After being the capital of the duchy of Juliers and Berg, Düsseldorf passed under the rules of the counts palatine of Neuberg, and then became the residence of the Elector-palatine John William, under whom it enjoyed great prosperity and became a centre of artistic work. It was taken by the French in 1795, restored to Bavaria by the Treaty of Luneville in 1801; in 1806 became the capital of the grand-duchy of Berg, with which it passed to Prussia in 1814. Pop. (1900) 213,767.

**Dust**, the fine particles of matter which float on currents of air, or settle on surrounding objects. Country air may contain only 200 particles of dust per cubic centimetre, while that of large cities may run up to 150,000, and in tenement houses as high as 1,000,000. These particles consist of sand, soot, cotton fibre, pollen, fine hair, pulverized excreta of animals, parts of seeds, bacteria, molds, etc. This is the ordinary condition of things. Frequently, as was the case after the Krakatoa eruption in 1883, the atmosphere becomes widely and densely charged with volcanic particles of varied minuteness, the smallest and lightest of which must take months, even years in settling. Remarkable color effects were produced in the heavens by the refraction of the sun's rays through these dust clouds. Aitken, a Scotch savant, has shown that no condensation of moisture (as in rain, mist, fog; see Fog) could occur without nuclei such as dust particles. He has also devised an apparatus for counting the number of dust particles in a given sample of air or gas. But one of the most important and serious questions concerning dust-laden air is the danger it brings to human life, as disseminating the bacteria of disease. Nearly one fourth of all deaths are due to consumption. Now the expectoration of a consumptive may contain millions of germs. Falling on the sidewalk or carriage-way of a city, it is soon tracked over a large area and gradually mixed with the dust; especially on asphalt pavements, where each wheel acts as a millstone, grinding everything into the finest powder, to be raised by passing vehicles into the air and sent into thousands of healthy lungs. The number of disease bacteria in the air has been calculated by many analyses. Taking 10 liters of air for a basis: in the Boston City Hospital the number of living bacteria was found to be nearly 450, and of molds 225. In a model New York hospital, where everything is supposed to be clean, 12 living germs settled on the disk, and, after sweeping, 226. In a New York tenement house carpeted living room, 75 living bacteria settled on the disk in an exposure of five minutes; after sweeping, 2,700, and mold settled on a plate or disk three and three quarters inches in diameter. Precautions have recently been taken against the peril of dust-spreading disease by constantly flushing the streets, and sweeping away all superficial dust into the sewers. The dust of such meteorites as undergo complete combustion on contact with atmospheric air, has been traced on the earth's surface; for example, on

## DUST-BRAND — DUTCH EAST INDIES

the inland ice of Greenland in the shape of particles of magnetic iron with cobalt. Dust of the same sort has been found on the snow of various northern regions, and scientific men have given it the name of cosmic dust.

**Dust-brand, or Smut**, a disease of certain plants, as oats, barley, corn, and other cereals. It is caused by a parasite fungi called *Ustilago*, which causes a swelling that at length becomes a powdery sooty mass. The common forms are *Ustilago segetum* and *U. carbo*; that which attacks Indian corn is *Ustilago maydis*.

**Dustin, Hannah**, American heroine; she was the wife of Thomas Dustin and was captured by the Indians during their attack on Haverhill 16 March 1697. Her youngest child, an infant one week old, was killed, but her husband, with their other seven children was successful in escaping. The mother, with her nurse, Mary Neff, was carried off and put in charge of an Indian family consisting of two men, three women and seven children. The captives on their way to a large Indian village halted at an island six miles above the present Concord, N. H. Here Mrs. Dustin and her nurse, assisted by an English youth, Samuel Leonardson, killed and scalped all the Indians in their sleep, excepting one squaw, and a small boy, and after a difficult journey in which they endured many hardships, reached home in safety.

**Dusty-foot.** See **PIEPOWDER COURT**.

**Dusty-miller**, a common name of some of the plants of the genus *Primula* of the primrose family, from the white flour-like appearance of the leaves. The name is also applied to *Cineraria maritima*, a native of the Mediterranean shore, and much grown in greenhouses.

**Dutch** is the anglicized form of the word *Dietsch*, *Deutsch*, or *Deutsch*, which in the Middle Ages was applied to the Teutonic people who spoke a language other than the Latin or the Romance languages. *Dietsch* means, "belonging to the common people; vernacular." While the term Dutch was once applied by English speaking peoples to Germany and things German it has long been restricted to the language and people of the Netherlands. The people of Holland call themselves *Nederlandsch* and use their forms *Deutsch*, *Nederdeutsch*, as the Germans do *Deutsch*, *Niederdeutsch*. For Dutch Language and Literature, see **NETHERLANDS**.

**Dutch Church**, the church to which the majority of the people of Holland adhere. In the 16th century the Dutch wavered for a time between the Lutheran Church, whose leader was the great reformer, and the Reformed Church, whose leaders were Calvin and Zwingli. In 1571 they publicly professed their allegiance to the latter by embodying its doctrines in the Belgic Confession of Faith, published in that year. As long as they were under the sway of the Spaniards they, however, abstained from the use of the word Reformed, which had been introduced by the French, and styled themselves "Associates of the Augsburg Confession," the Spaniards considering Lutherans more easy to govern than Calvinists. One of the most notable events in the history of the Dutch Church, after the yoke of Spain was broken, was the Synod of Dort, in 1618. James Arminius, professor of theology at Leyden, having rejected the Calvinistic tenets and adopted those which

were destined to be called after himself, Arminian, a synod was convened at Dort to examine and, if need be, condemn his views. This was done, but with little effect, the views of Arminius prevailing to a greater extent after than they had done before their condemnation. The government of the present Dutch Church is Presbyterian. See **LUTHER**; **NETHERLANDS**; **REFORMATION**; **ZWINGLI**.

**Dutch Clover**, a common name for the white clover (*Trifolium repens*), a valuable pasture plant, very common throughout the United States, probably naturalized from Europe. It is also a native of Siberia, and is found in all temperate regions. It has a creeping stem, the leaflets are broad, with a horse-shoe mark in the centre, and the white or pinkish-white flowers form a roundish head. The plant is so well known that it has a variety of familiar names, the best known English names being sheep's-gowan, honey-stalks, lamb-sucklings, and occasionally shamrock. In America it is called honeysuckle clover. See **CLOVER**.

**Dutch Concert**, a so-called concert in which every man sings his own song at the same time that his neighbor is also singing his. There is another form of Dutch concert, in which each person present sings in turn one verse of any song he pleases, some well-known chorus being used as a burden after each verse.

**Dutch Courage**, false or fictitious courage, usually applied to the bravado inspired by partial intoxication. The phrase probably originated in the 17th century, when England's wars with the Dutch, and especially the naval reverses England suffered at their hands in the reign of Charles II., rendered in England the very name "Dutch" a synonym for all that was bad.

**Dutch East India Company.** See **EAST INDIA COMPANIES**.

**Dutch East Indies**, the islands in the Malay Archipelago owned by the Dutch; situated between 6° N. and 11° S. latitude, and between 95° and 141° E. longitude. The names, area, and population of the divisions are as follows:

DIVISIONS	Area: English sq. m.	Population in 1900
Java and Madura.....	50,554	28,745,698
Sumatra, West Coast.....	31,649	1,527,297
Sumatra, East Coast.....	35,312	421,088
Island of Benkulen.....	9,399	158,767
Sumatra Lampongs.....	11,284	142,246
Palembang.....	53,497	692,317
Atjeh.....	20,471	110,804
Riau-Lingga Archipelago.....	16,301	74,483
Banca.....	4,446	106,305
Billiton.....	1,863	43,386
Borneo, West Coast.....	55,825	370,775
Borneo, South and East Dis- tricts.....	156,912	716,822
Island of Celebes.....	49,390	1,448,700
Celebes Menado.....	22,080	293,947
Molucca Islands.....	43,864	430,855
Timor Archipelago.....	17,698	119,239
Bali and Lombok.....	4,065	431,696
New Guinea to 141° E. lon..	151,789	200,000
Total.....	736,400	36,000,000

The areas given are accurate; but, except for Java and Madura, the population is estimated. The figures, however, are approximately correct, as the official records give the census every

## DUTCH GOLD—DUTCH REFORMED CHURCH IN AMERICA

five years. The population of some unexplored sections is not included. The last official returns give the total population, approximately 36,000,000, or about seven times as large as that of Netherlands. The number of Europeans in Dutch East Indies, in 1900, was 75,927; of Chinese, 460,000; of Arabs, 24,000; of people from parts of Asia other than China and Arabia, 27,000; and about all the remainder were natives. The chief occupation of the people is agriculture. The greater part of the land of the island of Java is government property, but in the western part there are a number of private estates. The government or the private owners of estates are entitled by law to one day's gratuitous work each week from each laborer on the estate, or, instead, to the payment of one guilder per head annually. Since the passage of the "agrarian" law in 1870 which granted waste lands on hereditary leases for 75 years, agriculture has increased in Java and the other islands. At first the government raised all the most productive articles as sugar, coffee, rice, etc.; but since 1891 the government has ceased to cultivate sugar, and it is now grown on the lands hired by the natives, or on lands held on emphyteutic tenure from the government. All the usual products are cultivated on private estates. The annual production of sugar has greatly increased from 1896 to 1901; the amount of coffee produced in the same time has decreased; cinchona has increased rapidly; tea, tobacco, and indigo have increased steadily. The yield of the tin mines of Bilton and Riouw, and of the coal mines of Java, Sumatra, and Borneo have increased each year. Buffaloes, oxen, cows, and horses are raised extensively. In India horses are not used for agricultural purposes.

Manufactories are increasing slowly; rice-mills, saw-mills, soap factories, ice and soda water manufactories are in some of the towns. In 1900 there were 3 government and 55 private printing presses. The principal articles of export are sugar, coffee, tea, rice, indigo, cinchona, tobacco, and tin. Nearly all of the exports, except rice, go to the Netherlands. The railroad and the mail and telegraph service is fair and is becoming better each year. The local revenue derived from land, taxes on houses and estates, from licenses, custom duties, personal imposts, some indirect taxes, and from the government monopolies of salt, opium, and railroads, and the sale of government products. About one-third of the annual expenditure is for the army and navy, another third for the general administration, and the balance for the local government administration. The "Java Bank" is controlled by the government. There are two other Dutch banks, several branches of banks in Great Britain, and a number of savings banks. The legal coins and the weights and measures are the same as for Netherlands. The local weights and measures are as follows:

The Amsterdamsch Pound	= 1.09 lb. avoirdupois.
" Pikol	= 133 $\frac{1}{4}$ lbs. "
" Catty	= 1 $\frac{1}{3}$ lb. "
" Tjengkal	= 4 yards.

In the administration of justice the principle observed is that Europeans and those assimilated with them, are subject to laws nearly similar to those in vogue in the Netherlands; and the natives are subject to their own

customs and institutions. The administration of justice for Europeans is in charge of European judges, while that for the natives is almost wholly in charge of native chiefs.

Schools are provided for all Europeans and natives. In 1900, there were five normal schools, four schools for sons of native chiefs, and the government and private elementary schools in Java and Madura numbered about 600, and for the outposts for the same year, 900.

Entire liberty of worship is granted to the members of all religious denominations. Christianity is increasing among the natives. In Java and the outposts, in 1873, there were 154,345 Christians, and in 1896, there were 309,258 Christians.

**Dutch Gold.** See DUTCH METAL.

**Dutch Guiana.** See GUIANA.

**Dutch Harbor,** Alaska, a port in the northeastern part of the island of Unalaska, situated on Bering Sea. It is a port of call for steamers passing through the Unimak Pass. See ALASKA.

**Dutch Language and Literature.** See NETHERLANDS.

**Dutch Liquid,** an oily liquid, known to the chemist as ethylene dichlorid ( $C_2H_4Cl_2$ ), which is obtained by the action of chlorine gas upon ethylene, and also as a by-product in the manufacture of chloral. It has anæsthetic properties, and is reputed to be quite safe; but it is irritating to the throat, and is therefore not used. The name relates to its early preparation by the Dutch chemists.

**Dutch Metal.** See COPPER.

**Dutch Oven,** a spider, skillet, or camp-oven used by those who cook by hot coals on the hearth, a mode yet common in the western States of the Union, and unsurpassed in its results with skillful housewives. The pot stands in hot embers, and more of the same are piled on the dish-shaped lid. The phrase is also applied to a cooking-chamber suspended in front of a fire so as to cook by radiation.

**Dutch Pink,** a yellow lake, prepared from bark of the quercitron (the dyer's oak), used in distemper, for staining paper-hangings, and for other ordinary purposes.

**Dutch Reformed Church in America.** The history of the Dutch Reformed, or Reformed Dutch Church, had its beginning in Switzerland in 1516 under the leadership of the heroic and devout Zwingli. Holland early felt the impulse of the Reformed faith as it came to her by way of the Palatinate, and through Swiss and French influences received it modified as to doctrine and polity. That Calvin had much to do in giving shape to the government of the Church in its Swiss home may account for that robustness of character by which in the early days the Reformed faith had so wide and powerful an influence and that heroic endurance to withstand the persecutions which befell it. These persecutions under the direction of Charles V. of Spain (1519-55) and his son Philip (1555-81) while disturbing in a greater or less degree the peace of those countries holding the Reformed faith, it was sturdy little Holland which received the full fury of the sword and under the leadership of William of Orange achieved those victories that gave her civil and religious liberty. In six years

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from 1567-73, over 100,000 men gave up their lives to purchase such liberty. Great enthusiasm was aroused by holy and learned men, who while preaching the Gospel in the open fields, also urged resistance to every power opposed to the progress of the Reformed faith. Added to this, the devotion of the people was expressed in song. The hymns of Beza and Marot became an inspiration. Men everywhere sang them as they stood in the thickest of that fight whose outcome they determined should be religious liberty for themselves and their children. But while the Prince of Orange was able in time (1576) to carry his negotiations so far as to bring about "the Pacification of Ghent," it was not uninterrupted peace. Out of those troublous times, in 1579, came the "Union of Utrecht." Seven northern provinces of Holland bound together by a common faith making this the motto of their covenant, *Eendracht maakt macht* ("Union makes strength")—a sentiment used to-day by the American Reformed Church on its seal. The independence of the northern provinces, however, was yet to give place to something broader and grander. It was the founding of the Dutch republic with a history too resplendent to be given in detail, excepting to say that her career in everything that ennobles a people—her universities, her diplomacy, her constitution, her arts, sciences, and her maritime and commercial power became, and are yet, the admiration of the world.

It was, however, in the darkest days of her history that Holland was busy in formulating the doctrinal standards of the Reformed Church, its liturgy and polity. It was in 1566 that some Walloon and Dutch pastors met at Antwerp, and, joined by a few nobles, proceeded to form the first regular Church organization. The Belgic Confession, written by De Beers, with some slight alterations, was put among its doctrinal standards. The Heidelberg Catechism, written by Ursinus and Olivianus of the Palatinate, was also accepted, but not fully endorsed until a later period. This Antwerp organization might properly be called the first synod of the Church of Holland. Doctrinal standards were endorsed and adopted, although declaring at the time that the Word of God was their only rule of faith, and much of this work was afterward confirmed by the greater synods that followed.

The Synod of Wesel was held in 1568. This synod did more toward shaping the policy of the Church. Calvin's Presbyterian polity was modified as suited their circumstances and adopted. A learned and godly ministry loyally endorsing their faith was made a necessity and the duties of church officers were carefully defined. Three years having passed with their land yet under the ominous cloud of Charles V., the Synod of Emden was called in 1571. The acts and proceedings of the Synod of Wesel were re-endorsed, with new features of church government formulated and arranged. The first Synod of Dort—the first of the national synods—was called in 1576 at Dortrecht, Holland. The government of the Church was farther perfected in defining the four grades of ecclesiastical bodies, namely: The general synod—the highest council, synod classes and consistories. It also declared what thereafter should be the conditions of church membership. Following this was the important Synod of Middleburg,

held in 1581. Its chief work was to complete the organization of the Church, arranging all matters relating to schoolmasters, professors of theology, liturgy, and creed, with which in the deposition of Philip II., a month later, the Reformed Church became the established Church of the Netherlands. The great Arminian controversy that was agitating the young Church in the early part of the 17th century was the immediate cause of the calling of the second Synod of Dort in 1618. All of the Reformed churches of Europe were invited to send delegates and most of them responded. James I. of England sent the Bishop of Llandoff, Samuel Ward, professor at Cambridge, and Joseph Hall, who afterward became Bishop of Salisbury. The doctrines of grace respecting fore-ordination, the perseverance of the saints, sin, and the conversion of man, the atonement, upon which Arminius was believed to hold unsound views, became subjects of earnest discussion. The Remonstrants who, headed by Episcopius, supported Arminius, were excluded from office in the Reformed Church and in a learned formula called the 'Canons of the Synod of Dort,' the synod's views upon these great doctrines were accurately defined. When the foreign delegates had withdrawn from the synod at the close of the 144th session, the Dutch delegates remained and acted as a third National Synod. These proceedings were called "post-acta," and much was done to develop much farther the working power of the young Church. The call to the ministerial office, festival days, hymns to be used in worship, baptism of adults and the sick, professors of theology and their relation to the Church, a new translation of the Bible into Dutch, foreign missions, profanity, the liturgy, and also ministers' salaries, were matters provided for. Yet again the Heidelberg Catechism came up for discussion and was re-adopted with enthusiasm, ordered to be taught in the schools, in the home, and explained in the churches every Sabbath. A 'Compendium' of its teachings was prepared and put among its standards of doctrine.

It was about this time that Holland immigration to America began. For 20 years before the Dutch East India Company had been pushing its commercial enterprises in the Indian Ocean. To find a shorter route to India it sent Hendrik Hudson on his voyage of discovery. The result was he explored in 1609 the river which bears his name. Five years later the country between Virginia and New France, or, measured on the coast line, from the 40th to the 45th parallel of latitude was taken possession of, made a province of in 1623 and was called the New Netherlands. In 1621 a West India Company, an armed corporation, with unlimited powers of colonization, and with great power on the sea was formed and with it Dutch immigration was more widely extended. Settlements began to form about New York Bay and in the vicinity, while Manhattan Island was at once occupied and held by the West India Company. In 1626 Peter Minuet, born of Huguenot parentage, an elder in the French Reformed Church at Wesel, came to America commissioned as director of the now powerful West India Company. To strengthen the company's hold upon Manhattan Island he bought it of the Indians for the sum of \$24. With the coming of Minuet began the first religious services in the

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New Netherlands. He brought over with him two *Krankenbesocckers* or comforters of the sick—devout men who in a commodious room over a horse-mill held religious services. These were held until the arrival of the first minister, Rev. Jonas Michaelius, early in 1628, when the first Church of the Reformed faith was organized in 1628. Fifty communicants were present at the first Lord's Supper, among them some Walloons. The Walloons were of the Reformed Church in Belgium, bordering on Holland, and who spoke the old French language, hence called by the Dutch *Waalche*, corrupted to Walloon. Many of them settled on Long Island in the vicinity of Wallabout, or Walloons bay or cove. The ecclesiastical connection of the new Church was with the Classis of Amsterdam in Holland. The Rev. Everardus Bogardus took the place of Michaelius in 1633. With him also came the first schoolmaster of the colony. The loft over the horse-mill was now replaced by a plain wooden church at what is now 100 Broad Street, between Pearl and Bridge streets, New York. The "dominie," as the minister was called, had a house and stable near. The Church now began to grow slowly, and accessions were made from other countries. Up to the time of the English conquest in 1664, and after various vicissitudes, there were 13 organized churches doing their work on American soil. Dutch immigration continued, and settlements were made in New Jersey, along the Hudson River as far as Fort Orange (Albany) and on Long Island, with good work done in adjacent settlements.

In the early part of the 18th century, the young Church began to feel the necessity of new pastors for their many vacant churches. It was getting to be inconvenient to look to Holland for men ordained by the Classis of Amsterdam. The necessity of managing their own Church affairs themselves, and of educating and ordaining their own ministry was now becoming imperative. How this could be done at first was not clear either to the Church in Holland or America. A Coetus, or an association, was finally proposed that might be given authority as a high judicatory in the New Netherlands and have the power of ordination. After much opposition both in Holland and in the colony permission was granted which existed for six years until 1754. In that year began the great disruption, when the young Church became divided into the Coetus and the anti-Coetus parties, but they came together again upon a basis of union of 1772. The Colonial Period, 1771-92, was now passing away and it was also a period of transition to the Church. Changed conditions made it necessary to broaden the 84 articles of the Synod of Dort by adding 73 explanatory articles adapting the whole ecclesiastical machinery to the entire freedom the Church was now enjoying. Minor changes were afterward made in the constitution of the Church at two different times and in 1867 the Dutch Reformed Church after a warm discussion became the Reformed Church in America.

The Church never had a widely scattered constituency—its growth has uniformly followed the lines of Dutch immigration—it is chiefly found to-day doing its quiet work throughout the States of New Jersey, Pennsylvania, New York, and in many of the Western States. The constitution of the Church consists of its

standards of doctrine, its liturgy, and its rules of government. Its liturgy has come down from the Church of Holland, but its use is optional, excepting the forms for the Lord's Supper, baptismal forms, and forms for ordination. In doctrine the Church is moderately Calvinistic. The fundamental thought is Divine Sovereignty, and in all its standards, what are called the doctrines of grace are given emphasis. Its standards of doctrine are the Belgic Confession, the Heidelberg Catechism, and the Canons of the Synod of Dort, together with a 'Compendium' explanatory of the Catechism. All ministers and teachers of theology are obliged to subscribe to these standards. The form of government is Presbyterian, having four church courts, the consistory consisting of the pastor and the elders and deacons, which are chosen from the congregation every two years, the Classis, a semi-annual convention of adjacent churches represented by pastors and elders, the Particular Synod, meeting annually, composed of ministers and elders delegated by each Classis, the General Synod, delegates appointed by each Classis, and elected by the Particular Synod. There is 1 General Synod, 5 Particular Synods, and 35 Classes representing 652 churches, and 700 ministers.

The Dutch Reformed Church has always insisted upon an educated ministry. Next to being the oldest body of Presbyterians in America, it may also claim to have established the first School of Theology (1784). Before that the ministers of the Church came from Holland, while a few went there for their education. The Theological Seminary at New Brunswick, N. J., with its six professors, is the result of the modest beginning. A second Theological Seminary is at Holland, Mich., and a third is connected with the Church's missionary work in India. This Church is also believed to have antedated any other body in founding the first college. A charter for a college was granted by Gov. Franklin of New Jersey in 1766, but a second and amended charter under which it organized was granted 20 March 1770, called Queens College, afterward changed to Rutgers College, and permanently located at New Brunswick, N. J. The New Jersey State Scientific School is also a part of the institution. The great immigration from Holland to Michigan and the neighboring States in 1847 and their prosperity made it soon appear that their high school which had passed under the control of the General Synod as Holland Academy, must soon expand to the proportions of a college. This it did in 1866 and Hope College took its place among the flourishing institutions of the West. A "board of education" to assist indigent and godly young men in pursuing their studies for the ministry was one of the early conceptions of the Church, and put in practical form in 1828. Later in 1865 the board was empowered by the Synod to co-operate with the Classes in the establishment of academies and classical schools.

The Dutch Reformed Church early imbibed the missionary spirit. Its home work was coincident with its history. As early as 1790, much work was done in scattered fields—in Canada, and later, in the Middle States and the West. "The Missionary Society of the Dutch Reformed Church," organized in 1822, had all the missionary work of the Church under its care. In 1844



## DUTCH RUSH — DUTCH WEST INDIA COMPANY

it took the name of "The Board of Domestic Missions," and much of the increase in the number of churches is due to its work. The Church did its Foreign Mission work through the American Board, beginning in 1832 and continuing until 1857, when it began its independent work. As the Board of Foreign Missions of the Church, it has had since that time in its several fields 200 missionaries. It has fields in India, China, Japan and Arabia, employing 80 missionaries, 350 native helpers, 27 native ministers, with 40 churches and nearly 5,000 communicants. One of the most invaluable helpers in this work was the organization of the Woman's Board of Missions in 1875, since which time it has contributed toward the general work more than \$600,000. Its contributions in 1900-1 were more than \$34,000. The young people of the Church are also organized in Christian Endeavor societies, co-operating with such societies everywhere in their work in the world. See CHURCH; PRESBYTERIAN.

REV. EVERT VAN SLYKE.

**Dutch Rush**, a common name for the scouring rush or shave grass (*Equisetum hyemale*), a plant of the horsetail family, used for scrubbing floors in country places, and imported from Holland as an article of commerce, to be used in polishing hard woods and alabaster. The stems are filled with silica deposited in a regular manner, forming an integral part of the plant. It is native throughout Europe, Asia, and nearly the whole of North America, where it is found in wet places, and along the banks of streams. See *Equisetum*.

**Dutch School.** See PAINTING.

**Dutch in the United States.** Holland's one effort at colonizing the northern New World was along the coast strip between the Hudson and Delaware (then known as North and South Rivers). Thence they penetrated inland, striking first of all up the Hudson to Albany, to establish fur-trade with the Indians, and thence westward to Schenectady; spreading east and west from New Amsterdam (New York), to the Connecticut settlements and on Long Island, and into New Jersey. They made a grasp at the Connecticut River, but were soon driven off it. The Delaware was fiercely contested with them by the Swedes, who left a strong impress there (see DELAWARE, *History*), but in vain; and the western side of New Jersey has considerable Dutch blood and settlement as well as the east, with not a little in Pennsylvania and Delaware. The English took all their possessions from them in 1664 (see NEW YORK, *History*), but of course did not root out their blood or traditions. The contribution of the Dutch to American institutions has been the subject of keen debate. Enthusiastic writers have credited them with pretty much everything distinctive of American institutions; partly and largely through the residence of the Pilgrims in Holland, it being assumed that the Pilgrims were unable to originate even such primitive ideas as that of confederations for protection except by imitating Holland; partly through the study of their institutions by the statesmen of the Constitution period. Democracy and religious freedom, written constitutions and the ballot, free religion and free schools, equal inheritances and state recording of deeds, have all been traced to

their example. Some influence on the Pilgrims is more than probable, especially in technicalities like the recording of deeds; and in the form of some few others there are significant similarities. But the wholesale character of their advocates' claims injures their cause. Democracy and equal inheritances were the result of the nature of the settlements; free schools existed among the Huguenots as well as the Dutch, and the people colonized on the basis of religious exposition of a book must train children to understand that book; the ballot is centuries older than Holland, and a written federal agreement was needed as security for its being kept. The extreme view is taken by Douglas Campbell, 'The Puritan in Holland, England, and America' (1892); a more moderate one by John Fiske, 'The Dutch and Quaker Colonies in America' (1899).

**Dutch West India Company, The**, an association of merchants of Amsterdam, Zealand, the Meuse, North Holland, and Friesland, incorporated 1621, with a capital of 6,000,000 florins (about \$2,500,000). Unlike the East India Company, which was primarily a trading association, and in its conquests and colonies had no other purpose than to protect its commerce, the West India Company never had an extensive trade, but strove to injure the Spaniards, to conquer their establishments, to capture their ships, and to break the intercourse between Spain and its American gold and silver mines. The design was conceived in the interest of the Belgians, when Spanish persecutions had driven more than 100,000 Protestant families from Belgium to the north. It was thought that the Spaniards would be compelled to evacuate Belgium when their resources had been thus destroyed. Large fleets were sent out, the company possessing sometimes as many as 70 armed vessels. The prizes captured were of such value that during several years shareholders received 25 to 75 per cent interest. Twelve millions were added to the original capital. Spain and Portugal being united at this time (the union lasting from 1580 to 1640), the company not only captured the Spanish silver fleet in 1628, securing a booty of more than 14 million florins, but took Bahia (1624) and Pernambuco (1630) in the Portuguese colony of Brazil. The history of Dutch Brazil had a brilliant period (1636-1642) under the administration of Count John Maurice of Nassau. Curaçao was taken about this time, and the company's North American colony of New Netherlands grew more and more prosperous. But the fatal defect of the company's plan now became apparent. Not being supported by extensive trade, the military and naval triumphs cost much more money than they produced. The financial condition of the company showed, after 1630, a terribly constant downward tendency; the government of Holland, moreover, was very slack in fulfilling its pledges of assistance. The beginning of the end was reached in 1641, when Portugal, having shaken off the Spanish yoke, devised means to regain Brazil. In 1654 the Dutch troops withdrew from that part of South America. The death-blow was struck when New Netherlands, the last valuable possession of the practically bankrupt company, was conquered by the English (1664). Consult: Asher's 'Bibliography of New Netherland and



## DUTCH WEST INDIES — DUTY

the Dutch West India Company,' Amsterdam, 1856-67.

**Dutch West Indies, The**, islands of the Caribbean Sea belonging to Holland. They are: Curaçao (area 210 sq. miles, pop. 28,187), the capital of which, Willemstad, is the residence of the governor of all these small Dutch possessions; Buen Ayre (area 95 sq. miles, pop. 4,399); Oruba; one half of St. Martin (total area 38 sq. miles, total pop. 3,724); Saba (area 5 sq. miles, pop. 2,065); and St. Eustatius (area 8 sq. miles, pop. 1,613). The last three are members of the outer and inner Caribbean chains, and lie 300 miles northeast of the Curaçao group, which is near the Venezuelan coast.

**Dutchman, The Flying**, a phantom ship which sailors believed could often be seen about the Cape of Good Hope. The story is that a Dutch captain, Vanderdecken by name, being tossed about by adverse winds while trying to double the Cape, swore with many oaths that he would accomplish his purpose if he beat to and fro till the judgment day, and as a punishment his ship never touched land. Another version of the legend is that the Flying Dutchman is condemned to wander the seas forever because a murder was committed on board his ship.

**Dutchman's Breeches.** See DICENTRA.

**Dutchman's Pipe**, a common name for *Aristolochia macrophylla*, a plant of the birthwort family (*Aristolochiaceæ*). It has a twining stem, with very slender branches, the leaves broad and thin. The calyx tube is bent in such a manner that the flower suggests a pipe with a long stem. It grows in woods from southern Pennsylvania to Minnesota, Kansas, and Georgia. See ARISTOLOCHIA.

**Dutra E Mello, Antonio Francisco**, ãn-tõ'-nê-õ frãn-thês'ko doo'trê ä mël'lõ, Brazilian poet: b. Rio Janeiro 8 Aug. 1823; d. 22 Feb. 1843. His verses are considered among the best of South American poetry. Among his choicest works are: 'A'noite Inspiração Poética'; 'A'noite de S. Toão'; and 'Historia Critica da Lingua Latina.'

**Dutt, doot, Romesh Chunder**, East Indian scholar and civil servant: b. Calcutta 13 Aug. 1848. He was educated at Presidency College, Calcutta, and University College, London, at which latter institution he is lecturer on Indian History. He joined the Indian civil service in 1871, becoming a divisional commissioner in 1894, the first native of India to attain that position. In 1892 he was decorated for ability as an administrator, and his literary researches. Beside a series of novels in Bengali, and translations of the 'Rig Veda,' etc., into Bengali, he has published in English: 'Civilization in Ancient India'; 'Lays of Ancient India'; 'Mahabharata,' condensed into English verse; 'Ramayana,' condensed into English verse; 'England and India, 1875-85'; 'Famines in India'; 'Economic History of British India'; 'Lake of Palms: a story of Indian domestic life.'

**Dutt, Toru**, Hindu poet: b. 1856; d. 1877. She received a good European education, and translated into English many French poems—from Béranger, Gautier, Coppée, etc. A collection of these was published as 'A Sheaf Gleaned in French Fields' (1876). She also rendered

into English some of the 'Ancient Ballads of Hindustan.' She wrote in French a story: 'Miss d'Arvers' Diary.'

**Dutteeah, doot'tê-ä, Dattiya, or Datia**, India, city, capital of a State of the same name, in the Bundelkhand Agency, on the route from Agra to Saugor, 110 miles southeast of Agra. The rajah's palace is situated within a pleasure ground of about 10 acres, inclosed by a lofty wall, with embattled towers at each of its four corners. A few miles distant are Jainas temples. (See JAINAS.) Pop. 27,566.

**Dutton, Clarence Edward**, American soldier and geologist: b. Wallingford, Conn., 15 May 1841. He was graduated at Yale in 1860, and two years afterward became captain of the First Connecticut Volunteers. He received a commission as second lieutenant in the United States army in 1863, and was promoted to the rank of major in 1890. In 1875 he joined Maj. J. W. Powell in the United States survey of the Rocky Mountain region; in 1879-80 was secretary of the United States land system committee, and from 1880 to 1891 was a member of the United States Geological Survey. He was elected a member of the National Academy of Sciences in 1884. His writings embrace the subjects of metallurgy, gunnery, and geology, to which last he has devoted his main literary attention. His most important geologic works are: 'Geology of the High Plateaus of Utah' (1880); 'Tertiary History of the Grand Cañon District' (1882); 'Hawaiian Volcanoes' (1884); 'Mount Taylor and the Zuni Plateau' (1886).

**Dutton, Edward Payson**, American publisher: b. Keene, N. H., 1 Jan. 1831. He was educated at the Boston Latin School, entered the book business, and was a member of the Boston firm of Ide & Dutton, 1852-8. Having acquired the publishing interests of Ticknor & Fields, and of the General Protestant Episcopal Sunday-School Union & Church Book Society of New York, he consolidated the enterprises and founded the New York firm of E. P. Dutton & Co.

**Dutton, Henry**, American jurist: b. Plymouth, Conn., 12 Feb. 1796; d. New Haven, Conn., 12 April 1869. He was graduated at Yale in 1818, and became professor of law in the same university in 1847, occupying this position for 8 years, and in 1854 was elected governor of Connecticut. He was judge of the superior court, and court of errors 1861-6, and prepared many digests and compilations of State statutes, which are of permanent value to his profession.

**Dutton, Samuel Train**, American educator: b. Hillsboro, N. H., 16 Oct. 1849. He was graduated at Yale, 1873, and was superintendent of schools in Brookline, Mass., 1890-1900. He was a lecturer on pedagogy at Harvard, 1895-7; Chicago University, 1897; Vassar College, 1897-8; and Boston University, 1898. In 1900 he was appointed professor of school administration, and superintendent of Teachers' College School, in connection with the Teachers' College of Columbia University. He has written: 'Social Phases of Education,' and several school textbooks.

**Duty**, a tax or impost levied upon imports and frequently upon exports. In the United States duty payment is in the nature of a tariff levy, and is determined largely by the appraised

value of the dutiable article itself. The list of dutiable articles is very large in the United States, France, Germany, and Russia. It is small in England. Merchants who have occasion to pay duty usually enlist the services of a custom-house broker, who is charged with the protection of his client's interests. Duty payments to the United States may in certain cases be deferred, the imported articles being held in bonded warehouses by the government. The stamp duty is a well-known tax in Great Britain. At the close of the Civil War and for a short time after the Spanish-American war, the United States levied a duty to meet war indebtedness by taxing medicines, matches, and other proprietary articles. See CUSTOMS DUTIES; STAMP TAX; TARIFF; etc.

**Duumvirs**, dū-ūm'vĕrs, among the ancient Romans, two magistrates, or officers, appointed for a particular purpose. They were therefore of various sorts, and were specially named from the nature of their functions. The *duumviri juri dicundo* were the highest magistrates of colonies, and towns, where they had the rank of consuls at Rome. The *duumviri navales* had charge of the construction and equipping, and sometimes of the command of fleets. The *duumviri quinquennales* were the censors of municipal towns.

**Duval, dū-vāl, Alexandre**, French dramatist: b. Rennes 6 April 1767; d. Paris 10 Jan. 1842. He served in the French fleet during the American Revolutionary War, and on his return to France was an engineer and architect; but finally devoted himself to writing plays, which won great favor from their skilful construction, interesting situations, and fine dialogue. The best are: 'Edward in Scotland' (1802); 'The Domestic Tyrant' (1805); 'The Youth of Henry Fourth' (1806); 'The Chevalier of Industry' (1809). He wrote the text of the very successful opera, 'Joseph in Egypt' (1807).

**Duval, Claude**, English highwayman: b. Domfront, Normandy, 1643; d. London 21 Jan. 1670. He went to England at the Restoration, in the train of the Duke of Richmond. Taking soon to the road, he robbed many gentlemen of their purses, and ladies of their hearts, till, having been captured while drunk, he was hanged at Tyburn, and was buried in the central aisle of Covent Garden Church.

**Duveneck, dū-vĕn-ĕk, Frank**, American artist: b. Covington, Ky., 1848. He began his artistic education as pupil in the studio of Dietz, at Munich, making a specialty of portraits and genre. Many of his pictures are in this country, although he has lived much abroad, and since 1881 has taught and painted at Florence, Italy. He was awarded a medal at the Columbian Exposition of 1893.

**Duvergier de Hauranne, Jean**, zhŏn doo-vĕr-zhĕ-ā dĕ ō-rān, French theologian: b. Bayonne 1581; d. Paris 11 Oct. 1643. At the University of Louvain, where he studied theology, one of his fellow students, and his most intimate friend, was Cornelius Jansen (q.v.), after whom a certain system of theological views is named — "Jansenism." The two friends, after both had left the university, continued their intimate relations, first at Paris, then at Bayonne, where Duvergier had been appointed to a prebend. When Jansen left Bayonne Duvergier resigned his prebend, and went back to Paris. All

this time the two men had diligently been studying the ancient fathers of the Church, and in particular St. Augustin, from whom Jansen claimed to have drawn his doctrine of Divine Grace. In Paris Duvergier's winning personality and his reputation for austere views of religious and moral obligations, commended him to the favor of the bishop of Poitiers, who gave up to him the monastery, or abbey, of St. Cyran, and there Duvergier, having brought together a number of devout men, formed them into a convent of monks, under the ancient, unamended rule of St. Benedict. But his zeal for reform of the monastic life was suspected of being inspired by a secret hostility to the Church and the Church's rulers, and Duvergier was compelled to retire from St. Cyran, whence he returned to Paris. There he was received with great favor by the highest society, especially the feminine element, and in particular he became the trusted counsellor of Angélique Arnauld, abbess of Port Royal, and all the members of the remarkable Arnauld family, those staunch defenders of Jansenism (see ARNAULD). A sect was formed and Cardinal Richelieu had strong suspicions that the Abbé of St. Cyran was leader in a conspiracy against Church and state; so he was arrested by order of the cardinal, and committed to the Castle of Vincennes 14 March 1638, where he was held in close confinement as long as Richelieu lived, or till December 1642; and he survived his liberation only a few months.

**Duvergier de Hauranne, dū-vĕr-zhĕ-ā dĕ ō-rān, Prosper**, French publicist: b. Rouen 3 Aug. 1798; d. Paris 22 May 1881. He went to London, and became in 1824 a constant contributor to the *Globe*. He was elected deputy from Sancerre, and in the national assembly he supported Casimir-Perier, and Thiers, while opposing Guizot, who had been his friend and associate on the *Globe*. After the *coup d'etat* of Napoleon III. he was imprisoned for a while, and eventually sentenced to banishment, but was subsequently allowed to return to Paris. He became a member of the Academy in 1870 and among the works which won him reputation is to be mentioned 'Histoire du gouvernement parlementaire en France' (10 vols., 1857-70).

**Duvernoy, Georges Louis**, zhŏrzh loo-ē dū-vĕr-nwā, French naturalist: b. Montbéliard 6 Aug. 1777; d. Paris 1 March 1855. In 1802 he was invited by Cuvier, to whom he was related, to assist in editing his treatise on comparative anatomy. With the aid of the notes and counsels of his master, he prepared the last three volumes of this work, embracing the organs of digestion, respiration, circulation, generation, and the secretions. In 1827 he was elected professor of the faculty of sciences at Strasbourg, where, during 10 years, he published a variety of papers on anatomical subjects; and after the death of Cuvier was engaged in arranging his papers for publication. In 1837 he was elected professor of natural history in the College of France. He published numerous works, which have furnished important materials to anatomists and zoologists.

**Duyckinck, dī'kĭnk, Evert Augustus**, American author: b. New York 23 Nov. 1816; d. there 13 Aug. 1878. Graduating from Columbia College, he studied law, was admitted to the bar in 1837, and went to Europe for a year, after which he devoted himself to literature, in

## DUYCKINCK — DWARFED TREES

which he was fertile and successful. With his brother, George, he prepared the 'Cyclopædia of American Literature' (1855; enlarged eds. 1865 and 1875). He was a voluminous and successful writer, and added much to the literature of his time. His last work was the preparation, with William Cullen Bryant, of an edition of Shakespeare.

**Duyckinck, George Long**, American author: b. New York 17 Oct. 1823; d. there 30 March 1863. He was a brother of E. A. Duyckinck (q.v.), and with him prepared the 'Cyclopædia of American Literature.' He was also the author of 'George Herbert of Bemerton' (1858); and 'Life of Bishop Thomas Ken' (1859).

**Duzine** (derived from the Dutch "dozijn"), or THE TWELVE MEN, the twelve patentees in 1677 of the Huguenot settlement on the Walkill, now in Ulster County, N. Y., and known as New Paltz (New Palatinate) from their German refuge after escaping from France. The "duzine" and their successors were the executive and legislative body of the settlement during a century.

**Dvorák, Antonín**, ä'n'tôn-în dvôr'zhäk, Bohemian composer: b. Mühlhausen, Bohemia, 8 Sept. 1841; d. Prague, Bohemia, 1 May 1904. At first intended for his father's trade of butcher, he showed such musical ability that he was allowed to study the organ. For a time he played the tenor violin in a theatre orchestra in Prague, and was also organist for several churches. In 1873 he first made himself known as a composer by a patriotic hymn for chorus and orchestra, and not long afterward an opera of his was successfully produced. His first great success was his setting of the 'Stabat Mater,' first performed in England in 1883, which at once raised him to the rank of a popular and widely-known composer. Among his subsequent works are songs, operas, dances, symphonies, a wonderful cantata, 'The Spectre's Bride,' first performed at Birmingham in 1885, the composer himself acting as conductor, and an oratorio, 'St. Ludmilla,' first performed at Leeds in 1886 under his own direction. Dvorák is characterized by a brilliant imagination, great originality, and a rare inventive power. His 'Stabat Mater,' which betrays less of the Bohemian nationality than many of his other works, is regarded as one of the greatest works of its kind in modern music. In 1892 he was called to New York as director of the National Conservatory of Music.

**Dwarf**, a human being much below the ordinary size of man. Dwarfs are described by several ancient classical writers. Herodotus gives an account of a race of dwarfs living in Libya and the Syrtes, to which Aristotle and Pliny also refer. Henry M. Stanley, in his journey across Africa in 1888, came on a dwarfish race which he thought might be descended from that mentioned by Herodotus. Philetas of Cos, distinguished about 330 B.C. as a poet and grammarian, was jocularly said to have carried weights to prevent his being blown away. He was preceptor to Ptolemy Philadelphus. Julia, niece of Augustus, had a dwarf named Coropas, two feet and a hand's breadth high; and Andromeda, a fremaid of Julia's, was of the same height. The best known of modern dwarfs was

Charles S. Stratton, or, as he was popularly called, "Tom Thumb," who was 31 inches high at the age of 25. He was born in Bridgeport, Conn., and traveled extensively abroad and at home under the management of P. T. Barnum. Wherever he went he attracted great attention, even from such personages as Queen Victoria and Napoleon III. Another modern dwarf was Francis Flynn, "Gen. Mite," who was 21 inches in height at 16 years.

In Scandinavian mythology dwarfs (*Dverggar*) are inhabitants of the interior of the earth, and especially of large isolated rocks. They were imagined to be dark in aspect like the caverns in which they dwelt, and were often styled "dark elves." A dwarf was set by the gods at the corner of each of the four quarters of the earth to bear up the sky; and they were named East, West, North, and South. All the dwarfs were esteemed great artists in working metals, and weapons of marvelous properties were said to be produced from their subterranean workshops. Like the Jotuns, they could not endure the sunlight, and if its rays touched them they were turned into stone. If a man met a dwarf away from his rock, and could throw steel between him and it, it was believed that thereby his habitation was closed up, and that any thing in his power could be extorted from him. In the old Norse, echo is called the "dwarf language," probably because it was thought to be produced by the dwarfs within mountains imitating the sounds which they heard without.

**Dwarf Snake**, a common name for small snakes of many genera, given in the United States to species of the genus *Carphophis*, which are found in the South in old logs. They are brown above and yellow or salmon below. The name is also applied to a pretty little snake of the genus *Haldea*, small and slender with coloring similar to the dwarf snakes of the first genus, but with a dark brown band across the head. It destroys insects and is harmless.

**Dwarfed Trees**, a favorite ornament for dwellings among the Japanese and Chinese, who adopt a peculiar method of dwarfing. They choose some fruit- or flower-bearing branch of any tree of which they wish to produce a dwarf specimen, and cutting off a ring of the bark, surround the stripped part with clay, which they keep moist by means of a covering of moss, which is watered when it becomes dry. After a period, varying in different trees from about 3 months to 2 years, roots are sent out by the branch into the clay. The branch is then cut off below these artificial roots, and planted in a poor soil, where it is kept scantily supplied with water. In this state the tree will remain for years, with vitality enough to produce leaves and even flowers annually, but never producing any but abortive shoots. Another method is to plant trees in flower-pots with a shallow covering of soil, supplying them, as in the former case, very sparingly with water, and pinching off all the strongest shoots. Still another method, which is said to give good results when tried by amateurs, is to enclose a seed in a small pellet of earth which is placed in the centre of a ball of absorbent moss, then is crowded into the interior of an orange from which the pulp has been removed. The moss is liberally supplied with water until the roots appear on the outside of the orange, when they

## DWARKA — DWIGHT

are cut off and the orange-skin covered with varnish, and placed in a flower-pot. Thereafter only enough moisture is applied to support the life of the plant.

**Dwarka**, *dwār'kā*, India, a maritime town of the district of Guzerat, on the west side of the peninsula of Kathiawar, in the dominion of Baroda, 235 miles southwest of Ahmedabad. On an eminence overhanging the seashore stands a great temple of Krishna, visited annually by 10,000 pilgrims. Dwarka is claimed as the birthplace of Krishna. Pop. 5,121.

**Dwight, Benjamin Woodbridge**, American educator and author: b. New Haven, Conn., 5 April 1816; d. in 1889. He was graduated at Hamilton College, New York, in 1835, and became a teacher, being engaged, during a large part of his life, as principal and proprietor of a school in Brooklyn and New York, in preparing boys for college. Among his works are: 'The Higher Christian Education' (1859); 'Modern Philology' (1864); and 'The True Doctrine of Divine Providence.'

**Dwight, Edmund**, American merchant: b. Springfield, Mass., 1780; d. 1849. He was graduated at Yale in 1799, and became the head of a flourishing business at Chicopee, and Holyoke. He was one of the main agents in establishing the Massachusetts State Board of Education, and the normal school system of the State.

**Dwight, Francis**, American educator: b. Massachusetts 14 March 1808; d. 15 Dec. 1845. He was graduated at Harvard College in 1827 and at the Law School in 1830; traveled extensively in Europe, and afterward practised law (1834-8), but in 1838 turned his whole attention to the promotion of common school education in our country, and established at Albany, N. Y., in 1840, 'The District School Journal,' under State patronage.

**Dwight, Harrison Gray Otis**, American missionary: b. Conway, Mass., 22 Nov. 1803; d. Shaftesbury, Vt., 25 Jan. 1862. He was graduated at Hamilton College, Clinton, N. Y., 1825, and became a missionary of the American Board of Commissioners for Foreign Missions in 1830, to the Armenians, making Constantinople the centre of his field of operations. He was abundant in his labors, and met with great success in his work. He wrote 'Researches of Smith and Dwight in Armenia,' and 'Christianity Revived in the East' (1850).

**Dwight, John Sullivan**, American musical critic: b. Boston 13 May 1813; d. Boston 5 Sept. 1893. After two years in the Unitarian ministry he became one of the founders of Brook Farm and was editor of its organ, the 'Harbinger.' In 1852 he established 'Dwight's Journal of Music,' in which appeared most of his scholarly musical criticisms. His best-known poem is 'God Save the State.' See Cooke, 'Biography of John S. Dwight' (1898).

**Dwight, Joseph**, American soldier: b. Hatfield, Mass., 16 Oct. 1703; d. Great Barrington 19 June 1765. He graduated at Harvard University in 1722; became judge of the court of common pleas of Hampshire County, Mass., and afterward of Berkshire County, and judge of probate. He was eminent both as a judge and a soldier. He commanded the Massachusetts artillery at the reduction of Louisburg in 1745 with distinction, and led a brigade at Lake

Champlain in the second French War in 1756. He was also for 11 years a member of the general council of Massachusetts.

**Dwight, Nathaniel**, American educator: b. Northampton, Mass., 31 Jan. 1770; d. 11 June 1831. He was a brother of Timothy Dwight the elder (q.v.) He prepared and published the first school geography ever issued in the United States, and was also the author of 'The Great Question Answered,' and 'A Compendious History of the Signers of the Declaration of Independence.'

**Dwight, Sereno Edwards**, American Congregational clergyman: b. Greenfield Hill, Conn., 18 May 1786; d. Philadelphia, Pa., 30 Nov. 1850. He was a son of Timothy Dwight (1752-1817). He was graduated at Yale 1803, and practised law in New Haven until 1816, when he entered upon a clerical career. He preached in Park Street Church, Boston 1817-26, and was president of Hamilton College, Clinton, N. Y., 1833-5. Among other works he published: 'The complete writings of Jonathan Edwards with a Memoir' (10 volumes 1830).

**Dwight, Theodore**, American journalist: b. Northampton, Mass., 15 Dec. 1764; d. New York 12 June 1846. He was a brother of Timothy Dwight, the elder. He was a well-known Federalist, a member of Congress, and wrote 'History of the Hartford Convention' (of 1814), and 'Character of Thomas Jefferson.'

**Dwight, Theodore**, American writer: b. Hartford, Conn., 3 March 1796; d. Brooklyn, N. Y., 16 Oct. 1866. He was a son of the preceding. He wrote: 'Tour of Italy' (1824); 'Summer Tour in New England'; 'The Northern Traveler'; 'The Kansas War' (1859); 'Life of Garibaldi' (1859); besides gazetteers, histories, and school books.

**Dwight, Theodore William**, American educator, jurist, and editor: b. Catskill, N. Y., 18 July 1822; d. Clinton, N. Y., 28 June 1892. He was educated at Hamilton College, and was professor of law there and subsequently in Columbia College, in each of which he founded a law school. He was elected (non-resident) professor of constitutional law in Cornell University in 1868. He was interested in philanthropic work, and served as president of the New York Prison Association, vice-president of the New York Board of State Commissioners of Public Charities, and as a member of the "Committee of Seventy," of New York. In collaboration with E. C. Wines he published 'Prisons and Reformatories in the United States,' and was associate editor of the 'American Law Register.'

**Dwight, Timothy**, American Congregational clergyman: b. Northampton, Mass., 14 May 1752; d. New Haven, Conn., 11 Jan. 1817. In 1769 he was graduated at Yale College, and in 1771 became a tutor there. In 1783 he was ordained as minister at Fairfield, Conn., where he opened an academy. In 1795 he was elected president of Yale College, and he also held the professorship of theology. His chief works are: 'The Conquest of Canaan,' and epic poem (1785); 'Theology Explained and Defended, in a Series of Sermons' (1818); 'Travels in New England and New York' (1821). Consult: Sprague, 'Life of Timothy Dwight,' in Spark's 'American Biography.'

**Dwight, Timothy**, American Congregational clergyman: b. Norwich, Conn., 16 Nov. 1828. He is a grandson of Timothy Dwight (1752-1817). He became professor of sacred literature at Yale Divinity School in 1858, and was president of Yale University from 1886 till 1898, when he resigned. He was one of the members of the New Testament Revision Committee. He published 'The True Ideal of an American University.'

**Dwight, William Buck**, American geologist: b. Constantinople, Turkey, 22 May 1833. He is a son of H. G. O. Dwight (q.v.). He was graduated at Yale in 1854, at the Union Theological Seminary, New York, in 1857, and at the Yale Scientific School in 1859. He has filled several educational posts in a scientific capacity, and since 1878 has been professor of natural history and curator of the museum at Vassar College. In 1891 he invented and patented a rock-slicing machine for the scientific section of minerals, for which he was awarded a bronze medal at the Paris Exposition of 1900.

**Dwina**, dwē'nā, **Dvina**, or **Northern Dwina**, a river of Northern Russia, formed by the union of the Sukhona and Withegda Rivers, in the government of Vologda. It flows northwest and enters Dwina Bay, an arm of the White Sea, about 25 miles below Archangel. The whole course, from the source of the Withegda, is over 1,000 miles. Canals connect the Dwina with the Volga and the Neva.

**Dyaks**, dī'āks, or **Dayaks**, the name of the natives of Borneo. They are divided into innumerable tribes differing pretty widely in language, customs, and degrees of savageness. Physically they closely resemble the Malays, to whom they are doubtless akin, but are somewhat taller; they are intelligent, hospitable, and unsuspicious, and greatly excel the Malays in truthfulness and honesty. Many of the dialects spoken by them are little known. The coast tribes have adopted many Malay words, and some have completely adopted the Malay speech. Even the most uncivilized tribes have many ingenious arts and industries, weave cloth, make excellent steel weapons, and erect most serviceable suspension bridges with bamboo poles and withes. Their chief weapon is the blow-pipe, not the bow. The barbarous custom of systematic head-hunting is dying out, though the heads of enemies are still cherished trophies of the warrior. See BORNEO.

**Dyce, Alexander**, English Shakespearean scholar: b. Edinburgh 30 June 1798; d. London 15 May 1869. He was educated at Exeter College, Oxford; and, taking orders, held several curacies prior to 1827, when he settled in London, where the most of his life was passed. He was first brought to notice by his 'Specimens of the British Poetesses' (1825), which was followed by editions of Collins (1827), George Peele (1828), Webster (1830), Robert Greene (1831), Middleton (1840), Beaumont and Fletcher (1843-46), Marlowe (1850), Shirley (1833), Skelton (1843), Wotton, and Drayton, all of which were accompanied by notes and biographies of the authors. In 1840 he founded, in conjunction with Collier, Halliwell, and Wright, the Percy Society, for the publication of ancient comedies and ballads. His chief labors, however, were devoted to Shakespeare, an

edition of whose works he published in 1857; second edition, greatly improved, nine volumes (1864-67). In his 'Remarks on Collier's and Knight's Editions of Shakespeare' (1844); he pointed out several errors into which the modern commentators on Shakespeare had fallen; and in another work, entitled 'A Few Notes on Shakespeare' (1853), he pronounced very strongly against the emendations of the text of Shakespeare published by Collier, and maintained by him to belong to the first half of the 17th century.

**Dyce, William**, Scottish painter: b. Aberdeen 19 Sept. 1806; d. Streatham 14 Feb. 1864. In 1830 he settled at Edinburgh, where he soon became known as a portrait-painter and as a distinguished contributor to the exhibition of the Royal Scottish Academy. In 1827 he had exhibited at the Royal Academy his 'Bacchus nursed by the Nymphs.' About 1837 he settled in London. In 1836 he exhibited 'The Descent of Venus,' the subject of which was taken from Ben Jonson's 'Triumph of Love'; and in 1839 'St. Dunstan separating Edwy and Elgiva.' When the decoration of the interior of the new houses of Parliament was made a subject of competition Dyce exhibited his talents in a new light, namely, as a painter in fresco. His first fresco, 'The Consecration of Archbishop Parker,' was executed in Lambeth Palace, and was followed by 'The Baptism of Ethelbert,' in the House of Lords (1846). In 1848 he was commissioned to paint a series of seven frescoes in the House of Lords, but he only lived to complete five. Among his other pictures are: 'Joash Shooting the Arrow of Deliverance' (1844); 'Virgin and Child' (1846); 'Omnia Vanitas' (1849); 'Meeting of Jacob and Rachel' (1850); 'King Lear and the Fool in the Storm' (1851); and 'John Leading Home the Virgin' (1860).

**Dyea**, dī'ā, Alaska, an unimportant village, which was, however, important during the gold-rush, as being the starting-point of the Chilkoot Trail, a much traveled pathway to the valley of the Yukon, and the Klondike fields. The building of a railroad from Skagway (q.v.) reduced Dyea to its present insignificance. The census of 1900 gives the place less than 300 population.

**Dyeing**. Dyeing is the art of staining or coloring yarn or cloth. It has been practised among the eastern nations from time immemorial, and in the sacred writings, we read of the vestments of the high priest being dyed purple, and of linen cloths being dyed blue, purple, and scarlet. The famous Tyrian purple is supposed to have been discovered by the inhabitants of Tyre 1500 B.C., and immediately afterward Tyrian purple became the badge of royalty, and cloth dyed with it commanded a very high price. The Egyptians, Grecians, and Romans practised the art of dyeing, and it gradually became more widespread as civilization advanced. In earlier times dyeing was much more extensively followed as a domestic art than at present.

If the various coloring matters used in dyeing had an affinity for the fibre in its natural state, the process would be very simple. It would only be necessary to make a solution of the dye drug and immerse the goods to insure their being dyed. But so far from this being



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the case, if we except indigo and safflower, there is scarcely a dyestuff that imparts its color to goods. The greater part of the dye drugs have so weak an affinity, for cotton goods especially, that they impart no color sufficiently permanent to deserve the name of a dye. The cause of this is obvious. If, for example, we take a decoction of logwood, the color matter is held in solution by the water. By putting a quantity of cotton into this solution, the fibre becomes filled with the colored solution, and if the cotton has no power to render that coloring matter insoluble within its fibres, it is plain that by taking out the cotton and putting it into water, the coloring matter within it will be diffused in the water. In other words, the dye having no attraction for the fibre, is washed out. This primary want of affinity makes dyeing sufficiently intricate and renders it more dependent upon science. Indeed, it is only by the careful arrangement of a few chemical laws, that the dyer is enabled to turn to advantage the various coloring matters of which he is in possession. When the dyer finds there is no affinity between the goods and any coloring substance which is put into his possession, he endeavors to find a third substance, which has a mutual attraction for the cloth and coloring matter, so that by combining these substances with the cloth and then passing the cloth through the dyeing solution, the coloring matter combines with the substance which is upon the goods and constitutes a dye. This third substance used, which acts as a mediator, combining two inimical bodies, is termed a mordant, from the French *mordre*, to bite, from an idea which the old dyers had that these substances bit or opened a passage into the fibres of the cloth, giving access to the color. Although the theory of their action is now changed, the term is still continued, and perhaps farther investigation will prove the term applicable.

All the mordants with one or two exceptions are found among the metallic oxides. In order that a substance may act as a mordant, it must possess certain properties. It must have an attraction for the coloring matter so as to form with it an insoluble colored compound and it must be held easily in solution. It may also have an affinity for the fibre and a tendency to unite with it, but this property is not essentially necessary; only the first two properties are so, and they limit the mordants almost entirely to what are termed the insoluble bases, that is substances which are not by themselves soluble in water. The bases or oxides, which are in general use as mordants, and which appear to succeed best are alumina and the oxides of tin and iron. The first two are colorless and the peroxide of the latter is a light brown and imparts to white goods the buff or nankeen color which in many cases affects to a considerable extent the color of the cloth, a circumstance which must also be attended to by the dyer. Indeed, the principal part of all dyeing operations is the proper choice and application of mordants; there being a chemical union between them and the coloring matter, a new substance is formed, not only differing in properties, but differing in color from any of the originals. Consequently, a very little alteration in the strength or quality of a mordant causes a decided alteration in the shade of color. However, it gives the dyer a much wider field for

variety of shades, and, at the same time, a less number of color substances are required. As, for example, logwood alone gives no color to cotton worthy the name of a dye, yet by judicious application of a few different kinds of mordants, all the shades from a French white to a violet, from a lavender to a purple, from a blue to a lilac, and from a slate to a black, are obtained from this substance. Before any chemical union takes place between bodies, they must not only be in contact, but they must be reduced to their ultimate molecules. Mordants that are insoluble of themselves, must be dissolved in some appropriate menstrua before their particles can enter the fibres of the goods or combine with the coloring matter. In doing this the dyer must attend to the degree of affinity between the solvent and the mordant to determine what force it will exert against the mordant combining with the fibres of the cloth should there exist an affinity between them. Otherwise, a powerful mordant may be weakened by the attraction of the solvent, as for example, common alum even though much concentrated, is but a weak mordant for cotton goods owing to the great attraction between the sulphuric acid and the alumina, but if the acetic acid, which has comparatively a weak affinity for the alumina, be substituted for sulphuric acid, it becomes a very powerful mordant.

It is with the vegetable coloring matters, however, that the greatest attention must be paid to the many conditions and properties of mordants. Bi-chromate of potash is largely used as a mordant for logwood and fustic for blues, blacks, browns, and a variety of shades of color. Bi-chromate of potash, alum, and oxalic acid as mordant on wool produce with logwood a very fine navy blue, but one that is not very fast to light. Sulphate of copper is used largely as a mordant with logwood for making black on cotton. These mordants are used almost exclusively for the wool dyes. In dyeing wool either raw, woven, or as yarn, care has to be taken that the wool is thoroughly free from grease before being mordanted. This is done by passing it through either soap, sal soda, or soda ash, and then thoroughly rinsing to free it from the alkali solution. If this is not done, unevenness in the dyeing is caused as well as a rubbing off of the color. When the dyer is given a shade to match he has to take into consideration the amount of fastness required, as where goods have to be heavily fulled, unless the colors are sufficiently fast, they will full out and be spoiled. In this case only such dyes can be used as will stand this process. The quantity of dye to be used depends on the class of wool to be dyed, as the finer the quality of the wool, the more dyestuff it takes to produce the same shade. The dyer also has to study to produce the result at the lowest possible cost, both for labor and dyestuff. Machines are now manufactured which economize in the labor and a large quantity of the goods are dyed at one time. It would be generally supposed that where the dyer carefully proportioned out his dyestuff to the weight of the material to be dyed, and observed every care in reference to the mordant and heat, that the shades would come out alike. However, this is not the case, and with the greatest amount of care the shades will vary and it is necessary to use extra skill



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after the shades get off the pattern to bring them again to the shade required. The dyer, knowing full well that owing to difference in the water and the stock in the goods, besides conditions that are not always understood, that the shade is apt to vary, goes light on the dyestuff and when he finds that he is not up to the shade required, he adds such dyestuff as is necessary to give the desired result. In fact, making the shade right when it is once off the pattern requires the very best efforts and skill on the part of the dyer. The dyeing of wool is a chemical combination. On the other hand, the dyeing of cotton is a fixation of the color in the pores of the cotton. Cotton is dyed in the raw state, pieces, and yarns, and the amount of dye used to produce a given shade also varies somewhat according to the quality of the staple. In using colors requiring a mordant, sumac and antimony are used, and the amount employed is governed by the depth of the shade required.

*Dyeing of Mixed Fabrics.*—The coloration of textile fabrics composed of more than one kind of material generally requires two or more processes, as the plan pursued in dyeing wool is seldom capable of fixing the color upon cotton. The customary plan followed is to immerse the fabric in the requisite baths to dye the wool and then to treat the partially dyed material in the manner found suitable for cotton. Occasionally the woolen thread of the cloth is dyed of one color, and thereafter the cotton is treated so as to acquire a different shade or color. With the coal tar colors recently brought out, mixed fabrics can be dyed in one bath, thus saving much time. The dyer is now able to produce, by combination of the different colors, a great variety of rich shades on mixed fabrics, and even to dye two shades in the same fabric, by first dyeing the wool with an acid dye, then cooling down his bath and adding his cotton dye, and dyeing the cotton another shade from what was produced on the wool. In dyeing silk, care has to be taken to free the silk from all gums, and this is done by boiling off in a soap bath. Most of the dyeing is done direct and under the boil.

In communicating the deep indigo blue to woolen cloth and yarn a vat is taken about six or seven feet in diameter, and eight to nine feet in depth, and nearly filled with water, along with from 18 to 22 pounds of indigo, finely ground in water, 10 to 20 pounds of madder, 7 to 9 pounds of bran, and 9 pounds woad. After the requisite boiling, and the addition of seven or eight pounds lime to form an alkaline liquid, in which the indigo can be held in solution, the whole is well closed over with tightly fitting wooden covers. Within 24 hours the putrid fermentation of the woad and bran proceeds the result of which is to abstract the oxygen from the blue indigo, the color of which is greatly reduced, until it assumes a yellowish color, and the solution then contains indigo white. If woolen cloth or yarn, is now dipped in this liquid, it comes out of a yellow tint from the attachment of the white indigo solution. But when exposed to the air, the oxygen immediately begins to act on the white indigo, combining with it so as to form oxidized or blue indigo, and as the process of oxidation proceeds, the yarn or cloth becomes first of a greenish and then of a blue color. If the cloth be again soaked in the yellowish

solution, and subsequently exposed to the air, the depth of the blue color may be increased, step by step, till it arrives at that deep shade of blue so well known.

In the dyeing of cotton with indigo the vat is prepared differently. The indigo is first ground into a thin paste with water, and afterward placed in a vat with protosulphate of iron and milk of lime. The lime ( $\text{CaO}$ ) takes the sulphuric acid ( $\text{SO}_3$ ) from the sulphate of iron ( $\text{FeOSO}_3$ ) forming sulphate of lime ( $\text{CaOSO}_3$ ), and liberating the protoxide of iron ( $\text{FeO}$ ), which immediately abstracts the oxygen from the blue indigo, reducing it to white indigo and the latter dissolves in the excess of lime present in the vat, yielding a colorless solution. When cotton cloth or yarn is dipped in this it comes out of the vat almost colorless, but on exposure to the air, the indigo becomes reoxidized and the cloth passes to a green and ultimately to a deep blue shade. The cloth or yarn is then washed in water and afterward soaked in a very dilute sulphuric acid to remove any oxide of iron remaining attached and rewashed in water, when the blue color becomes more bright and clear. Fast fulling colors dyed either in the wool yarns or pieces, are usually dyed with the alizarine colors on account of their being fast to fulling and light. These are usually mordanted with bi-chromate of potash and cream tartar for one and a half hours at a boil. Then they are thoroughly rinsed in cold water and finished in another bath with the alizarine colors. Owing to the great affinity existing between the alizarine colors and the mordanted wool, great care has to be taken to enter the bath at a low temperature and very gradually bring to the boil to insure the goods being dyed even. Extra care must also be taken that only the amount of the alizarine necessary is added to produce the shade. Cotton is now largely dyed direct. Formerly dyers were obliged to give a number of baths and even then were not able in a great many cases, to secure the brilliant shades that are now dyed in one operation. The color simply being fixed in the pores of the cotton, it is more difficult to secure a fast color on this fibre than on wool. As in the case of wool, dyeing machines are now manufactured by which the cotton is dyed both in the raw state, yarns, and pieces, which economize in the labor and enable the dyer to produce better results both as to shade and fastness. During the last few years, there has been a large addition to the coal tar dyes, thus giving cotton dyers a much better opportunity to produce brighter and faster colors. Some of these are dyed direct, and thus making a great saving of labor, besides some are very fast both to light and washing.

The yarns for carpets are dyed almost exclusively with the coal tar dyes. This is done mostly in the yarn, and are dyed direct by entering them in the dye bath, which has previously had added the color, with the proper proportion of sulphuric acid and Glaubersalt, and gradually brought to the boil, being turned by hand. The bath is generally exhausted in about three quarters of an hour. The yarns furnished the dyer are frequently of a mixed material which is dark in color and in this case, he must choose the very brightest of dyes to give the required brightness of shade. For the

finer grades of carpets, the color must thoroughly penetrate and in matching shades the dyer usually cuts his yarn and matches from the centre.

F. H. PRESCOTT,

*Expert in Dyes and Dyeing, Philadelphia.*

**Dyer, d'ér, Alexander Brydie,** American soldier: b. Richmond, Va., 1817; d. 1874. He was graduated at West Point, and joined the Third United States Artillery in 1837. He served in the Florida War of 1846, and was brevetted captain for gallant conduct. During the Civil War he was appointed chief of ordnance at Washington with the rank of brigadier general. In 1865 he was brevetted major general in the regular army.

**Dyer, Sir Edward,** English poet and courtier: b. Sharpham Park, Somersetshire; d. in London May 1607. An elegant courtier, he advanced himself in royal favor by court verse and was knighted in 1596. He will be longest remembered by his poem, 'My Mind to Me a Kingdom Is.' His works, 'The Shepherd's Conceit of Prometheus' and other poems, were not collected until 1872.

**Dyer, Eliph'ale,** American jurist: b. Windham, Conn., 28 Sept. 1721; d. there 13 May 1807. He was graduated at Yale College in 1840 and began law practice in 1745. During the French War of 1755 he commanded a Connecticut regiment; was elected a member of council in 1762; chosen delegate to the Stamp Act Congress in 1765, and served as a member of Congress during the War of Independence.

**Dyer, George,** English antiquary and scholar: b. London 15 March 1755; d. there 2 March 1841. He was educated at Cambridge, and from 1792 till his death lived by literary work in London. He edited 'Valpy's Classics' and among other writings, published a 'History of the University and Colleges of Cambridge' (1814). Talfourd refers to his 'simplicity of nature, not only unspotted by the world, but almost abstracted from it,' and speaks of him as "breathing out at the age of 85 the most blameless of lives, which began in a struggle to end in a learned dream."

**Dyer, John,** English poet: b. Aberglasney, Carmarthenshire, Wales, 1700; d. 24 July 1758. He was originally a painter and his sense of beauty in scenery is shown in his 'Grongar Hill,' a poem published in 1727. He took holy orders in 1740, and received the living of Calthorpe, Leicestershire, in 1841, but eventually settled in Lincolnshire. He published 'Ruins of Rome' (1840); and 'The Fleece' (1857), by which latter poem he is best known.

**Dyer, Louis,** American writer and lecturer: b. Chicago 30 Sept. 1851. He was educated in early years in Chicago, Switzerland and France, was graduated from Harvard in 1874; and afterward studied at Balliol College, Oxford. He was assistant professor of Greek at Harvard (1881-87), and settled at Oxford in 1890, where he was lecturer at Balliol College (1893-96). He has lectured before the principal colleges of this country and published among other works 'Studies of the Gods in Greece at Certain Sanctuaries Recently Excavated' (1891).

**Dyer, or Dyar, Mary,** American martyr: d. Boston 1 June 1660. She was a victim to the persecution which befell the Quakers in the

early history of Massachusetts. The government of Massachusetts by a statute excluded Quakers from the bounds of that colony, and sentenced to death any one of that sect who should be guilty of a second visit there. The statute was little regarded, or rather was construed as an invitation instead of a menace, by the enthusiastic and devoted believers against whom it was directed. Mary Dyer had departed from the jurisdiction of the magistrates upon the enactment of the law, but soon after returned on purpose to offer up her life. She was arrested and sent to prison full of joy, wrote from the gaol a remonstrance in which she pronounced her persecutors disobedient and deceived, was reprieved after being led forth to execution and after the rope had been put around her neck, and was against her will conveyed out of the colony. She speedily returned, and suffered as a willing martyr, being hanged on Boston Common.

**Dyer, Nehemiah Mayo,** American naval officer: b. Provincetown, Mass., 1839. He enlisted in the navy in 1861 and was promoted for gallantry in the Civil War, having attained the rank of volunteer lieutenant by 1865. He rose steadily through the grades to that of captain in 1897, and took part in the battle of Manila Bay the following year; was promoted rear-admiral in 1901 and retired the same year.

**Dyer, Oliver,** American journalist and author: b. Porter, Niagara County, N. Y., 26 April 1824. He was educated at Genesee Wesleyan Seminary, Lima, N. Y. In 1848 he was appointed stenographic reporter to the United States Senate, afterward became a reporter on the New York *Tribune*, and an editorial writer on the New York *Sun*. In 1871 he engaged to write exclusively for the New York 'Ledger.' He was ordained minister of the New Church (Swedenborgian), in 1876, but resigned from his charge at Mount Vernon, N. Y., owing to ill health. He is the author of: 'The Wickedest Man in New York' (1868); 'Great Senators of the United States Forty Years Ago' (1889); etc.

**Dyer, Sidney,** American poet and prose writer: b. Cambridge, N. Y., 11 Feb. 1814. He published a volume of poems entitled 'Voices of Nature' (1850); 'Songs and Ballads' (1857); 'Great Wonders in Little Things' (1871); 'Ocean Gardens and Palaces' (1877); 'Elmdale Lyceum' (1879); etc.; also 'Psalmist for the Use of Baptist Churches.'

**Dyer, Thomas Henry,** English historian: b. London 4 May 1804; d. Bath 30 Jan. 1888. He traveled and studied for years to prepare a 'History of Modern Europe' (1861); 'History of the City of Rome' (1865); and 'Ancient Athens' (1873); all monuments of learning and critical insight.

**Dyer, Sir William Turner Thistleton,** English botanist: b. Westminster, London, 28 July 1843. He was educated at Oxford, and beside holding other professional posts has been director of the Royal Botanic Gardens at Kew from 1885. He has edited: 'Flora Capensis'; and 'The Flora of Central Africa'; and is joint author of 'The Flora of Middlesex' (1869).

**Dyersburg, Tenn.,** city, county-seat of Dyer County; on the north fork of the Deer River, navigable as far as Dyersburg; on the

## DYER'S BROOM—DYES

Illinois C. R.R., and about 80 miles north-east of Memphis. The city owns its own electric light and waterworks plants; it contains a number of manufactories, chief of which are for flour, lumber, iron products, tobacco, and cotton and woolen goods. Pop. 3,800.

**Dyer's Broom; Greenweed Woadwaxen.** See DYE WEED.

**Dyer's-moss,** a lichen, called also archil or orchil. See ARCHIL.

**Dyer's Rocket, Dyer's Weed, or Weld,** a plant (*Reseda luteola*), of the mignonette family (*Capparidaceæ*). The plant is an erect herb, sparingly branched with long, narrow spikes of greenish-yellow flowers. The plant is extensively cultivated in Europe for the beautiful yellow dye it yields, and was originally grown in American gardens for the same purpose. It now grows wild in waste places, on Long Island, and in various spots near the eastern seaboard. It is known also as weld and woad.

**Dyer's Weed.** See DYER'S ROCKET.

**Dyes,** are employed in the various processes of dyeing, and when two or more are associated together, many different shades and colors are produced. The dyeing materials are procured from the mineral, animal, and vegetable kingdoms. Logwood is brought from Jamaica and from the eastern shores of the Bay of Campeachy, and on this account it is called Jamaica and Campeachy logwood. The former is much superior to the latter, owing to its having a larger percentage of coloring matter, and being of better quality, it brings a higher price. Fustic, or yellow wood, grows spontaneously in Brazil and in several of the West India Islands, where it attains to a great height and is used for producing yellow and in combination with logwood for producing various colors both on cotton and wool. There are two kinds of fustic, and to distinguish them, one is called young fustic. It is a shrub which grows principally in Italy and the south of France, where it is cultivated for the purpose of dyeing. When cut down it is stripped of its bark and broken into small pieces in which state it is met with in commerce. Quercitron is the inner bark of a tree which grows spontaneously in North America. Its dyeing properties were first made known to the public by Bancroft 1784. This gives a bright yellow orange color. Persian berries are the root of a plant growing in the Levant and south of France. They yield a bright yellow color, but are not largely used owing to the color being fugitive. Turmeric is principally brought from the East Indies. It is the root of a plant which is reduced to powder of a bright color although very fugitive, and is used for yellow, exclusively for cotton goods. Madder is a vegetable dye and rivals indigo as a dye drug not only for the beauty of the colors obtained from it, but also for the various shades it produces by combination of coloring matters. From this is made the fast turkey reds so well known. It is the root of a shrub and is cultivated in the Levant and several of the countries of Europe, including France and Holland. The East Indies also furnish a quantity. The madder not only furnishes a red but also a madder purple, orange, and brown. Archil coloring matter is procured from lichens growing on seaside rocks. The most esteemed is that which comes from the

Canary and Cape Verd Islands, but it is also found abundantly on the coasts of Sweden, Scotland, Ireland, and Wales. Camwood is another species of red-wood, imported from Sierra Leone. It produces a bright red color, which is permanent and for this reason has been largely used in the dyeing of wool, where especially fast colors were required. Barwood chemically the same as camwood, is brought also from Sierra Leone.

Indigo comes from plants growing in India, Africa, and America, called *Indigofera*, of which genus there are some 60 species. The coloring matter is found in the cellular tissue of the leaves as a secretion or juice, not however blue as we are accustomed to see indigo, but as a white substance, and is procured from the plant by fermentation. After the plant is fermented, the liquor is drawn and is agitated with paddles by the natives, until the indigo crystallizes out, when the clear liquor is drawn and indigo is taken out and pressed into blocks and dried. Latterly this has been done largely by machinery, which gives an indigo that is much purer than that made in the crude way by the natives. This indigo gives one of the most permanent dyes for standing light and for this purpose is greatly valued.

Sumac is diligently cultivated in Spain, Portugal, and some parts of Italy and Sicily. Sicily sumac is the best quality. This shrub grows to a height of about eight or ten feet. The shoots or shrubs are cut down every year close to the roots, and being dried are reduced to powder. Fine stems are often cut into small pieces and put in the powder. This is generally used when the metallic base or mordant is iron or tin and is therefore the bottom for blacks, reds, etc., for cotton dyeing. Sumac also grows largely in Virginia, and although having a very large proportion of tannin, owing to its leaving the cotton more or less stained, is not valued as highly as the Sicily and for this reason does not bring as high a price. See SUMAC.

Galls are certain species of oak excrescences, which originate in punctures made by insects for the purpose of depositing their eggs. Juice excretes from these punctures and gradually grows around the openings, varying in size from about a fourth of an inch to one inch in diameter. This substance from its resemblance to nuts and from its bitter taste is called gall-nuts. The best galls contain 26 per cent of tannin, and as they practically leave the cotton without being stained, are notwithstanding their much higher price, used where very light and bright shades are required.

Cochineal belongs to the animal kingdom, and is a small insect, largely found in Mexico, which gives a very bright crimson and scarlet. They feed on a cactus plant, which the natives cultivate around their buildings for that purpose. The insect attaches itself to the leaves of the plant and increases rapidly in number. During a season of seven months the insects are gathered three times, by brushing them off the leaves by the feather end of a quill into boiling hot water, in which they are kept for a few seconds. This not only kills them instantly but causes them to swell to twice their natural size. When taken out of the hot water, they are spread out and dried, and then packed for market. Some cultivators instead of hot water

## DYES

use steam and others again place them in an oven or upon a hot plate. The difference in the cochineal is caused by these different means of killing the insects and heating them. The best sorts seem as if dusted with a white powder and are of a slate gray color. Carmine is made from cochineal.

Weld or wold is a vegetable extensively cultivated in France and many other parts of Europe, for the purpose of dyeing yellow and is found in commerce in small dried bundles; the more slender the stem the better is it considered for dyeing. Both seeds and stems are used. The coloring matter approaches very near to quercitron in chemical properties. Owing to the color being extremely fugitive, it has been largely abandoned as a dye.

The most recent discovery of importance is the extraction of color substances of great beauty from coal tar. The discovery dates back to 1826, but it was not until 1861 that they commenced to be extensively employed. Those first placed upon the market were aniline purple, violine, rosine, fuchsine or magenta, solferina, *bleu de Paris*, aniline green or emeraldine, etc. The tar consists of numerous classes of bodies of which aniline and benzole are two. Aniline is present in minute quantity, and for manufacturing purposes, means are generally resorted to for the conversion of the benzole of the tar into aniline. The coal tar colors in many instances are not only more brilliant in shade but easier of application. These are now so largely used that they are almost entirely displacing the dyes formerly employed. When first brought out, it was found that they were not able to resist the sunlight like many of the old dyes, but in recent years, great improvements have been made in this respect, and many of the coal tar dyes, as improved, are not only noted for beauty of shade but for fastness to light as well as being economical to use, and more certain in results. Some of the coal tar dyes are made in the United States, but at the present time, Germany is far ahead of all other countries in the manufacturing of these colors, and it has grown to an immense proportion; some of the German works employing as high as 5,000 people. Among the coal tar colors are the alizarines; alizarine red, blue, and yellow, which now almost entirely take the place of madder.

The so-called aniline reds are the salts of rosaniline from which we derive most aniline colors. Aniline red, under the name of fuchsine or magenta, is prepared by adding anhydrous bichloride of tin by degrees to aniline. The materials are constantly stirred during the operation to keep down the intensity of the action, and the result is that much heat is evolved. The mixture becomes pasty, then liquid and brown and as the temperature approaches the boiling point it becomes a dark, almost black liquid, which in very thin layers presents a rich, crimson color. This liquid is boiled for some time. Much water is added and the whole is reboiled so as to volatilize any free aniline and chloride of sodium (common salt) added until saturation, when fuchsine or magenta is precipitated as a golden green, semi-solid pitchy substance. Any resinous matter still remaining may be separated by digestion in benzole. This dye may also be obtained by acting upon aniline with nitrate of mercury. Fuchsine or magenta is

sparingly soluble in water and dissolves to some extent in alcohol and is insoluble in ether and naphtha. Roseine is most readily prepared on the commercial scale by adding two equivalents of pin-oxid of lead to a boiling solution of one equivalent of sulphate of aniline, and boiling the whole for a short time. On filtration, a rose-colored solution is obtained, then evaporated down to small bulk when some resin separates and the roseine is precipitated by soda or potash, and being collected on the filter can be washed and dried. This dye is readily soluble in alcohol and yields a very intense crimson color, which on being evaporated to dryness leaves a dark, metallic looking and brittle residue of roseine. It is soluble in water, but not in naphtha.

Aniline violet was the first aniline color manufactured. It was discovered by Perkin 1857. It is a sulphate of mauveine, known under the name of mauve, indisine, etc., and produced by oxidizing sulphate of aniline by bi-chromate of potassa. Tarry substances are formed at the same time, which are removed by dissolving them in hydrocarbons such as naphtha. This violet or purple is hardly soluble in water, but easily so in alcohol and sulphuric acid. The imperial purple of Girard and de Laire is obtained by heating together salt of rosaniline, magenta, for instance, with its own weight of aniline at a temperature of 350° F., for several hours. All the unaffected aniline is removed by weak acids and the purple remains. The regina purple of Nicholson is magenta heated to a temperature of from 390 to 420° F. The substance melts, evolves ammonia and a new color is produced. Blues can be obtained from these violets by washing them several times with diluted hydrochloric acid in order to dissolve all the aniline and magenta undecomposed and also a violet color. Aniline blues generally contain some violet and the violets some red shades in them. We find in the trade, blues with violet shades and violets with red or blue shades. Repeated washings will remove the violet, which is more soluble than the blue. But we must not consider the violets as simply mixtures of blue and red. The different shades are salts of rosaniline, in which hydrogen has been replaced by the radical phenyl. By varying the proportions of magenta and aniline and also the temperature various shades of violet are obtained. A true blue is prepared by adding to the mixture of magenta and aniline an organic acid or salt such as benzoic, acetic acid, or acetates. A blue thus obtained is called night blue, on account of its remaining blue under artificial light. Aniline greens are obtained by treating four parts of magenta by six of oil of vitriol, and two of water. Then 16 parts of aldehyd are added and the whole is kept at a temperature of boiling water until a few drops of the liquid give a blue color to a weak solution of sulphuric acid. The liquid is then poured into a solution of hyposulphite of soda and the green is "fixed." This green bath can be used directly for dyeing. It does not keep very long, but the color may be precipitated by tannin or acetate of soda. The insoluble compound is employed for calico printing and forming new dye baths. An iodide of ethyl green is produced by boiling Hoffman's violet with water and carbonate of soda. The liquor is treated by picric acid, a green precipitate is formed, which is washed, dried, and

sold in powder. It is soluble in alcohol, and, we believe, in water after trituration of the powder with two or three times of its weight of sal ammoniac. Aniline blacks and grays are developed on the cotton fibre itself. Lightfoot, who discovered aniline black, if black is a color, used a paste composed of chlorate of potassa, hydrochlorate of aniline, sulphate or chlorate of copper and starch enough to thicken. By the mutual oxidizing reaction of chlorate of potassa and chlorate of copper the aniline is oxidized to the degree of black. This paste was open to the objection of destroying metals. Further experiments made by Cordillot, Koechlin, and Lauth, led to these important facts, namely, that the hydrochlorate or nitrate of aniline are the only aniline salts which can produce a black, that the best aniline should be a mixture of aniline and toluidine, that the presence of copper is indispensable, and that a sulphide of copper, prepared by precipitation, will not corrode metals, and will gradually absorb the quantity of oxygen for its transformation into sulphate. If a tartrate or acetate of aniline is used, it is necessary to add to the mixture a certain quantity of sal ammoniac which will furnish the muriatic acid necessary for the transformation of the tartrate or acetate of aniline into a hydrochlorate. Aniline grays are obtained by diminishing the proportion of black producing substances of the above receipts by keeping as much free acid as in the primitive mixture for black. The maroon of M. de Laire was made by melting four parts of anhydrous hydrochlorate of aniline with one of dry aniline oil, the temperature slowly rises to 465° F. The operation is over when yellow vapors begin to appear and the mass is constantly transformed into brown. The color is soluble in water. Leucaniline brown is obtained by Koechlin in the following way: A salt of rosaniline is transformed into leucaniline by zinc powder. The leucaniline is separated from the zinc by alcohol, and this being evaporated, a tartrate of leucaniline may be formed, which is afterward transformed into brown by the oxidizing action of a mixture of sulphide of copper and chlorate of potassa.

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**Dyeweed, Dyer's Broom, Greenweed, or Woodwaxen**, a plant, *Genista tinctoria*, the only American representative of the genus *Genista* of the pea family. The genus comprises about 80 species, natives of Europe, northern Asia, and Africa. The dyeweed is a low-branching shrubby weed, with a few yellow nearly sessile flowers. It was originally cultivated in New England gardens because of the green dye it produced, and escaping is found from Maine to eastern New York. Its medicinal value is small, although it is used in Russia as a specific for hydrophobia.

**Dygasiński, di-gäs-ën'skē, Adolf**, Polish story writer: b. Russo-Polish government of Kjebyz 1839. His stories are remarkable for charming descriptions of scenery; among them are: 'On the Manor'; 'From Village, Field, and Forest' (1887); 'From City and Country' (1889). He has translated works by Max Müller, Tyndall, Mill, Lewes, and others.

**Dyherm, di'härn, Baron George von**, German poet and novelist: b. Glogau 1 Jan. 1848; d. Rothenburg, Silesia, 27 Dec. 1878. He wrote

many poems and tales of great merit; 'In the Still Hour' (1870) being a collection of his best verse; and 'From Society' (1880), and 'Heights and Depths' (1881), his ablest fictions.

**Dying Declaration**, a deposition made by one who is near to death. Such declarations are admitted as evidence both in England and Scotland.

**Dying Gladiator**, a famous work of ancient sculpture, representing the scene of a dying Gaul, and supposed to be one of a series of figures illustrating the incursion of the Gauls into Greece. The work is now preserved in the museum at Rome. It is not known whether the statue is an original or a copy, the work of Cresilas, a Grecian sculptor and contemporary of Phidias. The right arm of the statue has been restored, and it is not positively known by whom this restoration was made. The work has been credited to Michael Angelo.

**Dyke.** See DIKE.

**Dykes, James Oswald**, Scottish clergyman: b. Port Glasgow 14 May 1835. He entered the Presbyterian ministry in 1859, and in 1869 became minister of the Regent Square Church in London. Since 1888 he has been principal and Barbour professor in the Theological College of the Presbyterian Church of England. He is the author of: 'Beatitudes of the Kingdom' (1872); 'Laws of the Kingdom' (1873); 'Relations of the Kingdom' (1874); 'From Jerusalem to Antioch' (1874); 'Abraham, the Friend of God' (1877); 'Daily Prayers for the Household' (1881); 'Sermons' (1882); 'The Law of the Ten Words' (1884); 'The Gospel According to St. Paul' (1888); 'Plain Words on Great Themes' (1892).

**Dykes, John Bacchus**, English composer: b. Hull 10 March 1823; d. 22 Jan. 1876. He was graduated at Cambridge; ordained in 1847, and was appointed precentor of Durham Cathedral in 1849. In 1862 was presented to the vicarage of St. Oswald's in Durham. He was a joint-editor of 'Hymns Ancient and Modern,' and composed, besides many services and anthems, a number of hymn tunes, most of which are to be found in all English collections. Among these are: 'Nearer, My God, to Thee'; and 'Jesus, Lover of My Soul.'

**Dynam'eter**, an instrument for measuring the magnifying power of a telescope. This power is the ratio of the solar focal distance of the object glass to the focal distance of the eye-piece considered as a single lens; this being the same as the ratio of the diameter of the aperture of the telescope to the diameter of its image or disk formed at the solar focus, and seen through the eye-piece, the object of the instrument is to measure the exact diameter of this image, which can be either projected on mother-of-pearl or measured by optical means.

**Dynam'ic Theory**, an hypothesis broached by Kant that all matter originated from the action of two mutually antagonistic forces — attraction and repulsion. All the predicates of these two forces are attributed by Kant to motion. As applied to heat, it is a theory or hypothesis — that now generally accepted as the correct one — which represents a heated body as being simply a body the particles of which are in a state of vibration. This vibratory movement increases as the body is still more heated, and diminishes



## DYNAMIC UNITS—DYNAMO ELECTRIC MACHINERY

proportionately as it more or less rapidly cools. It is called also the mechanical theory of heat.

**Dynamic Units.** See UNITS.

**Dynam'ics** (Gr. "power"), that branch of theoretical mechanics which treats of forces. It is to be distinguished from "kinematics," which treats of the various kinds of motion that are possible in a given system, without discussing the forces to which these motions are due. In this encyclopædia dynamics is treated as a sub-heading under MECHANICS (q.v.).

**Dynamite** (from Greek *dynamis*, power), an explosive invented by Nobel in 1866 and originally consisting of infusorial silica or diatomaceous silica, called "kieselguhr," and nitroglycerin. The kieselguhr, being composed of the siliceous skeletons of micro-organisms, is a very fine, dry powder with a great capacity for absorbing and holding liquids, and it will absorb and retain three times its own weight of nitroglycerin, so that the product contains 75 per cent by weight of the nitroglycerin, and is known as dynamite No. 1. Other grades are made by adding less nitroglycerin to the absorbent or dope. The name has now been extended to cover a great variety of pulverulent or plastic solid mixtures of which nitroglycerin is a component.

Dynamite is fired by means of a detonator or blasting cap. As the percentage of nitroglycerin in dynamites with inert bases is reduced, they become more difficult to detonate until when the nitroglycerin is below 30 per cent they can not, according to Howe, be detonated at all. This does not hold true for dynamites with active bases. Dynamite is usually put up in cylindrical brown paper wrappers, closed at each end and coated with paraffin. These cartridges or "sticks," as they are called, are usually from one to two inches in diameter and eight inches long, and they are packed for transportation in sawdust in wooden cases, there being 50 pounds in each case. The sticks are paraffined to prevent water reaching the dynamite, as this drives the nitroglycerin out of the kieselguhr dynamites and dissolves the nitrate of soda in the nitro-lignin dynamites, thereby diminishing their efficiency. Good dynamite is of about the consistency of fresh mold. It varies greatly in color according to the absorbent used, magnesia powder being snow white, kieselguhr dynamite No. 1 pearl gray to red, carbo-dynamite black, the lignin dynamites about the color of coarse brown sugar. There is usually a little sodium, calcium, or magnesium carbonate, mixed with the dope. Dynamite keeps as well as the nitroglycerin, from which it is made. It is safer than the latter, because it avoids the liquid state, while from its softness it will bear blows better. Its sensitiveness to blows increases very rapidly with the temperature, so that, according to Eissler, "at 350° F., the fall upon it of a dime will explode it." At ordinary temperatures it may be exploded by firing musket balls into the mass. The firing point of dynamite is about 180° C. (356° F.), and at this temperature it either burns or explodes. If free from all pressure, jar, vibration, or force of any kind, it burns; otherwise, it explodes. If a thin layer be placed on a plate of tin and heated over a burner the nitroglycerin volatilizes or takes fire. If the layer is of any considerable depth, say over a quarter of an inch, it explodes. This is

a dangerous experiment. When heated to any temperature less than this, it is exploded by a detonator, blow, jar, or vibration with an ease dependent on the temperature and time of exposure. When ignited in comparatively small quantities dynamite simply burns away fiercely, but with moderate and larger amounts ignition causes explosion. To safely destroy dynamite it should be treated with a solution or emulsion of an alkaline sulphide such as the spent lime from gas works. High temperatures, much below the ignition or explosion temperature, cause the nitroglycerin to exude, or in technical terms, "they will make the powder leak," hence a dynamite should be made to resist exudation at the highest temperature to which it may be exposed.

Dynamite freezes at about 40° F., and remains frozen at temperatures considerably exceeding this. If solidly frozen it cannot be detonated except with great difficulty and uncertainty, but if loose and pulverulent it may be detonated, though the efficiency is much diminished, hence when frozen it is practically useless as a blasting agent, and must be thawed or "tempered" for use. This operation requires great care and the instructions issued with each case should be closely followed. Many persons suppose that since cartridges of unfrozen dynamite may sometimes be set on fire and burned without exploding, it is safe to warm it upon a shovel, or in an oven, or to boil it over a stove, or in various other ways which usually lead to a verdict of "accidental death." It cannot be too strongly impressed upon the minds of those handling it that if dynamite or other nitroglycerin preparations are gradually warmed up to a temperature approaching their explosion temperatures they become extremely sensitive to the least shock or blow, and once that point is reached they do not simply ignite, but they explode with great violence, and further that, owing to the poor conductivity of the mass, a portion of it may become raised to this temperature and explode the whole.

Dynamite has a specific gravity of 1.5 to 1.6. In his earlier experiments with absorbents Nobel in 1863 placed gunpowder in a zinc case and filled the interstitial spaces with nitroglycerin. This might be called a dynamite with an active base, but that the nitroglycerin was greatly in excess of that existing in dynamites. See EXPLOSIVES; NITROGLYCERIN; POWDER.

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**Dynamo Electric Machinery**, machinery which transforms mechanical energy into electrical energy, or which converts electrical energy into mechanical energy. A dynamo electric machine consists of two distinct parts, one of which is stationary, the other part being rotative. When the rotary element is driven by an external force and the machine develops electrical energy, it is termed a generator or a dynamo. If electrical energy be supplied to the machine and the revolving element develops mechanical energy, the machine is termed a motor. Special types of machines in which both dynamo and motor action are present are treated later.

The operation of dynamos is due to the principle of electro-magnetic induction discovered by Michael Faraday in the year 1831. He noticed that when a loop of wire of several turns was



## DYNAMO ELECTRIC MACHINERY

revolved between the poles of an electro-magnet a flow of electric current took place in the wires of the loop. The rotation of the loop was about an axis perpendicular to the lines of force emanating from the pole.

The term electromotive force represents the pressure which forces an electric current through a circuit. In a dynamo its magnitude depends upon the rate of cutting of magnetic lines of force. These lines of force are imaginary and indicate the magnitude and direction of the force of a magnetic field. To continuously produce an electromotive force, continued cutting of lines of force is essential. The magnitude of the electromotive force induced in a loop which is revolving in a magnetic field is directly proportional to the rapidity with which the loop is revolved, to the number of turns of wire in the loop, and to the strength of the magnetic field. The direction of the E. M. F. induced in a loop depends upon the position of the loop relative to the poles. When one of the wires of a loop passes one pole, an E. M. F. is induced in the wire which tends to send a current in one direction; this direction changing as the wire cuts the flux at the other pole. Opposite sides of the loop pass poles of opposite polarity simultaneously, a current therefore tends to flow in one direction around the loop. The direction of the E. M. F. in the loop changes as the wires pass from a north to a south pole. When the loop is connected to two slip rings, as illustrated in Fig. 1,

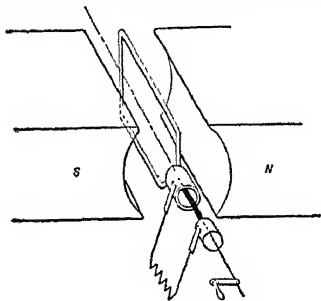


FIG. 1.

and revolved, an alternating current may be obtained by attaching to the slip rings suitable collecting devices. The substitution of a two-part commutator, Fig. 2, for the slip rings will rectify the current and produce a direct current, or a current which flows continuously in one direction.

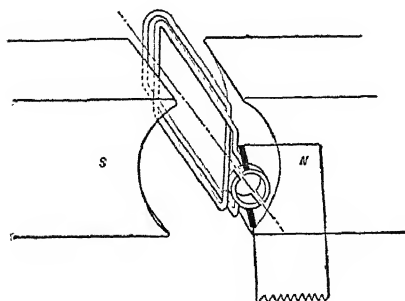


FIG. 2.

Dynamo electric machines are divided into two distinct classes, those which generate a

direct current and those which generate an alternating current. It is customary, with a few exceptions, to term the part of a machine in whose coils the E. M. F. is generated the armature, and the parts that produce the flux, the field magnets. Dynamo electric machines are further classified as to their mechanical operation into machines in which: (a) The armature revolves and the field magnets are stationary; (b) The field magnets revolve and the armature is stationary; and (c) The field and armature coils are stationary and iron core revolves. It is obvious from previous mention that a dynamo electric machine may generate either a direct or an alternating current depending upon whether it is supplied with a commutator or with slip rings. Machines termed rotary converters possess both a commutator and slip rings, their function being to convert alternating into direct current or *vice versa*. If the machine be driven by an external force, either direct or alternating current may be obtained by making the proper brush connections. The rotary converter when operated in this manner is termed a double-current generator. As the construction of the armatures of direct current machines, rotary converters, and a large number of alternating current machines is similar with the exception of their commutators or slip rings, the construction of the armature of a direct current machine will be given in detail.

**Direct Current Armatures.**—A direct current rotative armature consists essentially of three parts, an iron core mounted upon a shaft, a number of conductors wound upon the surface of the core or embedded in slots near the surface, and a commutator.

**Core.**—The object of the core is to facilitate the passage of lines of force from one pole of the field magnet to another. If this core were not present fewer lines of force would pass through the armature, and this would tend to decrease the E. M. F. generated by the machine. For equal magnetizing forces a sample of iron may carry 2,500 times the number of lines of force that would be carried if air were substituted for it.

The periphery of the armature core of large machines is usually slotted longitudinally, the purpose of which is to contain the conductors. This also tends to decrease the air space, termed the air gap, between the core and the pole faces, a thing which is very desirable.

The core is composed of iron disks punched from sheets. These disks are punched out whole for small machines, or are made in segments, the junctions of which are staggered in large machines. The disks in machines of large capacity are mounted upon a form of proper dimensions, which in turn is fastened to a spider and keyed to the shaft. The punchings are assembled with their planes perpendicular to the axis of rotation. The reason for using disks instead of a solid casting is that the iron core is equivalent to a conductor revolving in a field. Currents, termed Foucault currents, flow through the iron in the direction of the axis if the disks are not properly insulated. This current unduly heats the armature and is therefore undesirable.

**Armature Windings.**—The wires distributed over the periphery of the core of an armature constitute the generating part of a direct current machine. Armatures in which the windings are only upon the periphery are termed drum arma-

## DYNAMO ELECTRIC MACHINERY

tures. When the core of the armature is in the form of a ring and the wires are wound in and out around the ring the armature is called a ring armature. Drum armatures are in use commercially to a greater extent than ring armatures particularly in the case of large machines. In the drum armature a greater portion of the winding is active in producing an electromotive force than in the ring armature. The ring armature has considerable wire upon the inner face of the ring in which very little electromotive force is induced.

The length of active conductor connected in series on an armature determines the magnitude of the electromotive force generated by a given magnetic field. In machines of large magnitude two volts or more are generated per foot of active conductor.

Many forms of armature winding are in vogue. The designing engineer is often called upon to design a machine of given capacity which will generate a certain pressure at a definite speed. To do this he must place sufficient wire in series to produce the required E. M. F. and this wire must be of sufficient cross-section to carry the current it will be called upon to deliver. To meet these conditions and still have an armature which is not abnormal in size often results in a very complicated series multiple winding. Machines of large capacity usually have more than one pair of poles and have brushes between successive poles around the commutator. These serve to conduct the current to the main circuit.

An economical method of winding drum armatures consists in the employment of formed coils. These coils are wound upon a collapsible form of proper dimensions and after being thoroughly insulated and shellacked are removed from the form. They are then inserted in the slots of the armature core. The distance between the two halves of the loop is nearly equal to the distance between the centres of two poles of opposite polarity. The terminals of the loop are connected to two adjacent commutator segments. The next loop is placed in slots and similarly connected, care being taken to connect the two coils in series to a common commutator segment. By this method the current tends to flow in one continuous direction. Many modifications are made to this form of winding but the principle of connecting the coils so that their E. M. F.'s will be cumulative is common for all machines. Some machines have two or more separate windings upon the same core.

**Commutators.**—A commutator consists of an assemblage of drop forgings, or castings of copper called segments, Fig. 3, which are thoroughly insulated from each other. These segments are assembled around a tube. The tube is threaded at both ends to receive nuts to hold the segments together. Mica is usually employed to insulate the segments from each other, from the nuts, and from the tube. In addition to its high insulating properties, mica possesses the advantage that it wears under the brushes at about the same rate that copper does. This maintains a smooth surface at all times upon the surface of the commutator. The maximum voltage between adjoining segments is seldom allowed to exceed 20 volts. Assuming that the voltage is uniformly distributed, a 240-volt machine with a closed winding would therefore have 12 bars between adjoining brushes, or for a 2-pole machine 24 commutator segments. In Fig. 3 the perpen-

dicular projection, "P," of the commutator segment protects the coils on the armature, and is made to receive the extremities of the coils of the armature windings. The wires in some cases are fastened to the lugs, "P," with set-screws and then soldered. The commutator complete is keyed to the armature shaft.

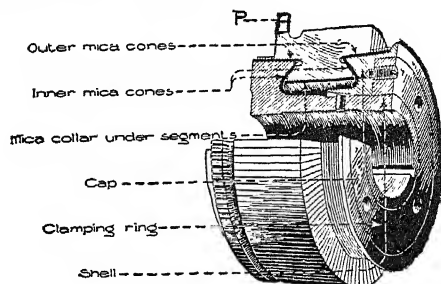


FIG. 3.

**Brushes.**—Carbon and copper are the two materials usually selected for brushes; carbon for high potential machines and copper for low potential machines. When a coil is entering commutation it has a current of electricity flowing in it. The direction of this current changes when the coil is commutated. The current flowing in the coil before commutation tends to keep up because of its self-induction. In the time it takes a strip of insulation to pass under the brush, the current flow in the coil must be stopped, and a current of equal value started in the opposite direction. Both operations may be done by counter E. M. F., or the current flow may be stopped by a high resistance and started by fringe flux. The transition resistance of brush to commutator usually causes a fall in the potential of about one volt for every brush. The pressure of the brushes against the commutator varies, the average value is about 1½ pounds to the square inch. The necessary area of rubbing surface of carbon brushes is one square inch for 200 amperes, and copper brushes permit of 40 amperes for the same cross-section.

**Field Magnets and Field Frame.**—The field magnets produce the magnetic flux in which the armature rotates. The flux is created by a current of electricity traversing many turns of wire which are wound upon iron cores. A north or a south pole is produced, depending upon the direction in which the current flows through the coil. The coils on the field magnets are connected in series and so arranged that the polarity changes consecutively from pole to pole. Modifications are sometimes made to this form of winding when it is desirable to produce a machine which will supply a three-wire circuit. The machine is then designed as a four-pole machine having two adjoining north poles and two south poles similarly placed.

The laws governing the flux of magnetic lines are similar to the laws of current flow. The flux which will flow in a magnetic circuit is equal to the magnetizing force (termed the magnetomotive force) divided by the reluctance of the circuit.

$$\text{Flux} = \frac{\text{Magnetomotive Force}}{\text{Reluctance}}$$

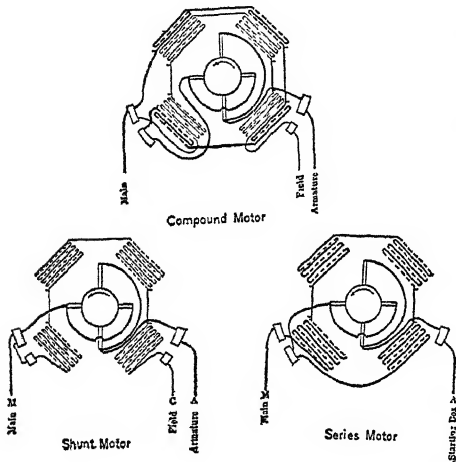
The reluctance of a magnetic circuit is a property analogous to the resistance of an electric circuit. To obtain a maximum flux through

## DYNAMO ELECTRIC MACHINERY

an armature with a given magnetomotive force it is necessary to reduce the reluctance of the magnetic circuit to a minimum.

In the design of a generator it is often convenient to first design the armature and then obtain the magnitude of the flux which must be generated by the field magnets. Having selected a given material for a field frame, a given air gap, a given length and cross-section of magnetic circuit, the total reluctance of the circuit is determined. The reluctance varies directly as the length of the circuit, directly as the reluctivity of the material and inversely as the cross-section. Knowing the total flux and the reluctance of the circuit, the magnetomotive force is determined, and this quantity divided by 1.257 gives the number of ampere turns necessary to produce the magnetic field.

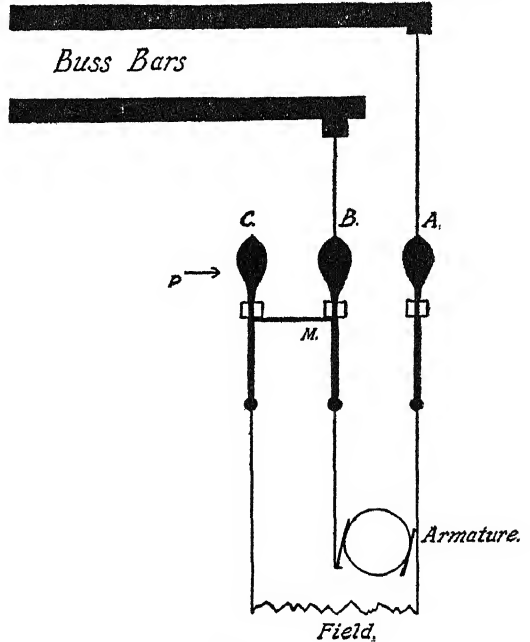
**Field Coil Connections.**—Dynos and motors may be shunt wound, series wound or compound wound. In the series dynamo the



armature circuit, the field circuit, and the external circuit are all in series. Series motors are used for traction purposes as they give a large starting torque. Series dynamos are used for arc lighting, as they generate a constant current. Shunt wound machines have their field circuit, their armature circuit, and their external circuit connected in multiple. A shunt machine is designed to generate a constant potential, or when operated as a motor to run on constant potential. The field coils of a generator may be separately excited, in which case an external source furnishes the current for exciting the coils. Separately excited machines are usually employed in large power houses where it is desirable to have a flexible system, which means the ability to vary the pressure sent out on the line at any instant of time. In the United States where 8,000 horsepower generators are now in successful operation, each machine is taken as a unit and the control of the exciting current for the fields is a very important factor. The machines are separately excited; the exciting dynamo being supplemented by a bank of storage batteries as an emergency. A compound winding consists of an additional winding upon the field, this winding being connected in series with the line. It may be placed in series with the armature and the field connected in multiple, or it may be con-

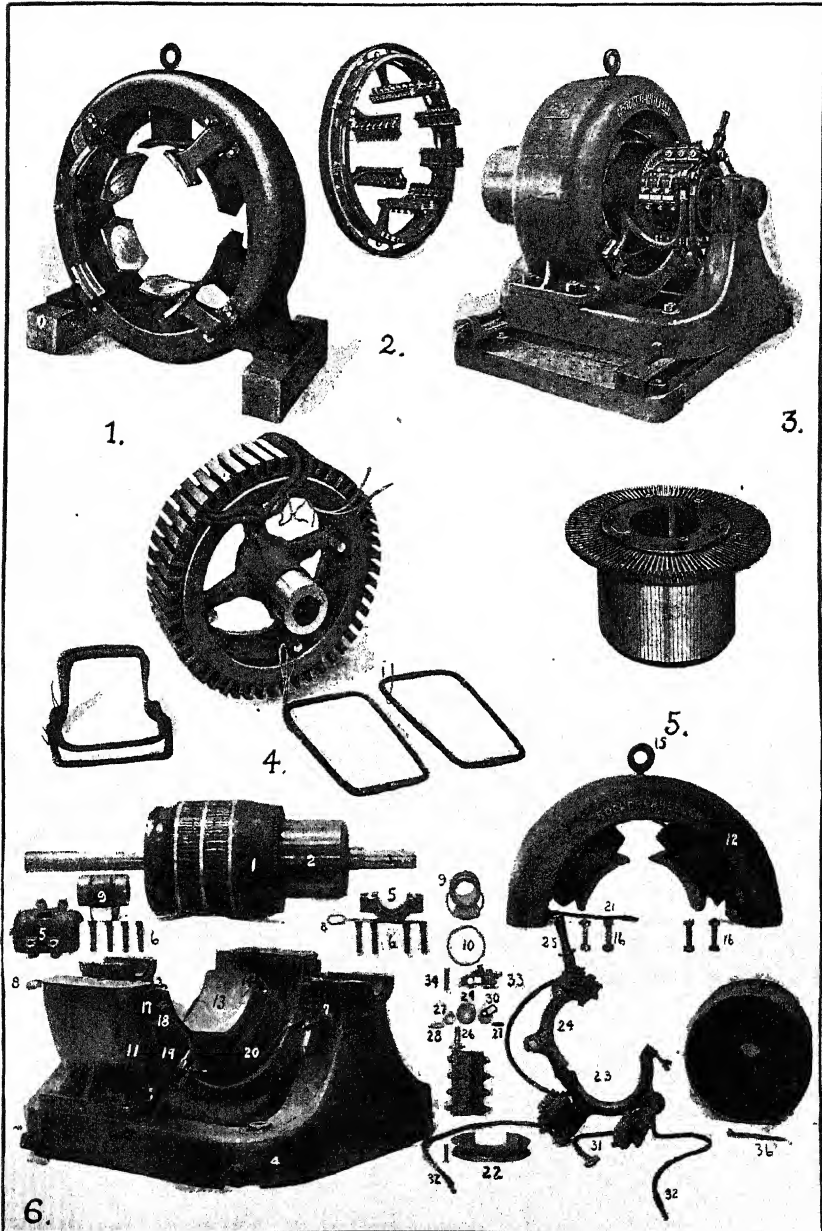
nected in series with the armature alone, its connection depending upon the percentage of compounding required. By compounding a machine the strength of the magnetic field is increased in proportion to the current generated by the machine, the percentage depending upon the number of turns in the compound coil and as to the way in which it is introduced in the circuit. If a shunt machine be not compounded, the potential falls with an increase above normal of the generator output.

**Methods of Excitation.**—A dynamo electric machine may be separately excited or self-excited. When self-excited, the machine builds up slowly to its normal potential, and when disconnected from the main circuit the field magnets gradually discharge themselves as the speed of the machine decreases. The polarity of a self-excited machine may become reversed or the machine may fail to generate sufficient pressure to magnetize the field magnets. Both of these conditions are serious. When the field coils of the separately excited machine are connected to



an external circuit they definitely assume their proper polarity and there is no possibility of this polarity becoming reversed. In addition to this the field magnets of the separately excited machine rapidly build up to the point where the machine generates its normal potential. The disadvantage of this machine is that when disconnected from its external exciting source its fields must be instantly discharged through a bank of lamps or some other consuming device, as there is danger of the fields discharging through the insulation of the machine. A method devised by Mr. Donshea embodies the advantages of both the separately excited machine and the self-excited machine and lacks their disadvantages. The method consists of the operation of a specially devised three-part switch. Fig. 4. The single switches A and B are closed, connecting the field magnets of the generator to the source of separate excitation. The field magnets quickly

# DYNAMO-ELECTRIC MACHINERY.



1. Multipolar Field Frame.
2. Rocker Arm and Brush Holder.
3. Direct Current Dynamo, Complete.
4. Direct Current Armature Core, showing Method of Winding and Applying Formed Coils.
5. Commutator.
6. Dissected Direct Current Dynamo: 1. Armature (includes 2 and 3); 2. Commutator; 3. Shaft; 4. Base; 5. Bearing Cap; 6. Bearing Cap Screws; 7. Oil Cock; 8. Oil Hole Cover; 9. Journal Box; 10. Oil Ring; 11. Lower Magnet Frame (includes 13 and 14); 12. Upper Magnet Frame (includes 13

and 14); 13. Pole; 14. Pole Shoe; 15. Eye Bolt; 16. Magnet Frame Bolts; 17. Terminal Board; 18. Terminal Block; 19. Compounding Rectifier; 20. Field Coil; 21. Field Cable; 22. Rocker Seat with Screws; 23. Brush Rigging (includes 24, 25, 26, 27, 28, 29, 30, 31, 32 and 33); 24. Rocker (includes 25); 25. Rocker Handle; 26. Brush Stud; 27. Brush Stud Nut; 28. Brush Stud Insulating Washer (Round Hole); 29. Brush Stud Insulating Sleeve; 30. Brush Stud Cable; 31. Armature Cable; 32. Brush Holder; 33. Brush; 34. Pulley; 35. Pulley Key.



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and definitely assume their proper polarity. The switch C is closed when the machine is generating the proper potential. The machine then returns power to the circuit which may be the buss bars of the switchboard. When the switch C is closed a catch on the handle engages the switch B at the point P. When it is desired to disconnect the machine from the circuit, the handle M is engaged which carries switches B and C out together. The machine is then equivalent to a self-exciting machine and the fields gradually disappear as the machine slows down.

**Speed Conditions.**—Consider a motor operating under normal conditions from an external supply of E. M. F. The armature of this motor is rotating in a magnetic field and therefore has an E. M. F. induced in its armature windings. The direction of this E. M. F. is such as to tend to send a current of electricity in the opposite direction to that passing through the armature under the influence of the external supply. This E. M. F. is termed the counter electromotive force. The pressure of the external source remains approximately constant, and the counter E. M. F. varies with the armature speed. As the motor is loaded its speed tends to decrease. This decrease diminishes the counter E. M. F., and a larger current is permitted to pass through the machine. The difference between the impressed and the counter E. M. F.'s divided by the resistance of the armature gives the magnitude of the armature current. It is obvious that a very large current would flow through a stationary armature of low resistance, if the armature

an induction motor, and which made possible the economic long-distance transmission of power. This motor had two great advantages over the direct current motor, in that it possessed no commutator or brushes to be cared for, and it could be operated by alternating currents. It possessed the disadvantage that there was no ready means of regulating its speed. There is considerable difference between the construction of an induction motor and that of a direct current motor. Induction motors have a revolving element whose laminations are somewhat similar to those of the armature of a direct current motor, as they fulfil the same function. The movable part of an induction motor is called the rotor, and the stationary element surrounding the rotor is called the stator. In a common form of rotor, called the squirrel cage, the inductors are insulated and embedded diagonally in slots around the periphery, and at each end of the rotor these inductors are connected together to a common ring. The coils of the stator which create the magnetic field are so wound that several out-of-phase alternating currents have their magnetic actions superimposed upon each other and thus produce a field which continually shifts. This field is termed a rotating field. The stator field induces currents in the rotor which react upon the field and cause the rotor to revolve. The motion of the rotor is not synchronous with respect to the field of the stator, but slower. The ratio of the deficit of the rotor speed to the speed of the stator field is termed the slip of the induction motor.

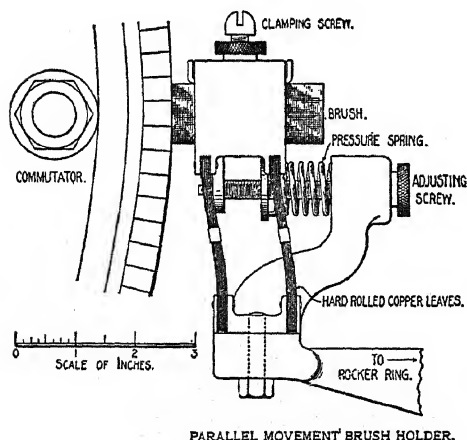
**Safety Devices.**—There are many large power houses in the United States continuously generating 40,000 horsepower and over. The units employed in these power houses range as high as 8,000 horsepower. Since the introduction of the steam turbine there has developed a tendency to increase the size of these units to 12,000 horsepower. One of these units would generate sufficient power to replace all of the electrical power developed in Switzerland. New York has under course of development and in operation power houses whose output will aggregate 750,000 electrical horsepower when completed. When the new power houses at Niagara are in operation, almost 500,000 E.H.P. will be developed. The management of many of these power houses claim to have given continuous service since first installed. They have been able to give this service to the public by having duplicate pieces of apparatus in many cases and by protecting their entire system from excessive overload and strain, and from the elements by suitable protecting devices.

**Fuses.**—The simplest protecting device consists of a fuse. Fuses are made in many forms. The link fuse is made in strips, or as wire of an alloy possessing a low melting point. When the current strength exceeds a certain limit, the heat developed in the fuse by the pressure overcoming the resistance of the fuse is sufficient to melt it and interrupt the service.

**Circuit Breakers.**—Where heavy currents have to be interrupted an electromagnetic device termed a circuit breaker is employed. This device consists of an electromagnet of low resistance placed in series with the circuit. When the current in the circuit exceeds the normal amount, the magnet attracts an armature which releases a catch, and allows a spring to open the switch governing the circuit.

were connected directly to an ordinary commercial lighting or power circuit. To prevent this large current flow, devices called starting boxes are employed for starting motors. The function of a starting box is to first complete the exciting circuit of the field magnets and then to gradually cause a rise of the impressed potential upon the armature terminals, from zero to that of the supply circuit. The latter is accomplished by gradually diminishing resistance which is in series with the armature until the speed of the machine is almost normal, when all the resistance is entirely removed.

**Induction Motors.**—In the year 1888, Mr. Nikola Tesla, of New York, introduced a dynamo electric machine, which is now termed





## DYNAMO ELECTRIC MACHINERY

*Time Limit Relays.*—Generators are liable to be subjected to an excessive overload for a short period of time. This sudden variation in load often occurs in the operation of railroad trains, mining machinery, mills, and machines of a similar nature. It would be very inconvenient to have breakers open the circuit whenever these sudden variations in load occur, especially as the generators are usually designed to stand an overload of 25 per cent for half an hour, and an overload of 50 per cent for one minute. The time limit relay performs the same function that a circuit breaker does, namely, opens the circuit whenever an excessive overload occurs. There is this difference, however, between the two devices: the operation of a circuit breaker is practically instantaneous, whereas a time limit relay has a time element associated with it. This time element is adjustable and may be arranged so that the circuit will be opened after a definite interval of time following the overload. In one form the magnetic action of the relay is opposed by a bellows, or a dash-pot, which contains air. When the relay begins to operate a solenoid draws a plunger down, which in turn compresses air in a receiver. The force exerted by the compressed air is lessened by leakage. When the limit is reached, say five seconds, the circuit is automatically opened.

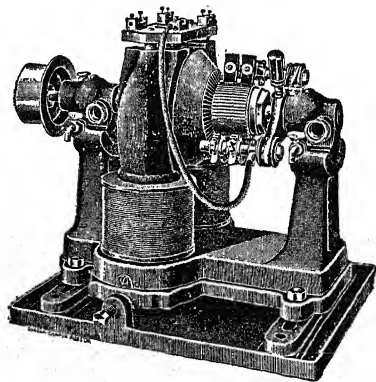
*Reverse Current Relay.*—If a generator become disabled and is unable to develop a pressure equivalent to that generated by machines linked in with it, there is a possibility of a large cross-current flow into the disabled generator from the other machines. To prevent power returning into such a machine a device termed a reverse current relay is employed which automatically cuts out the machine from the service.

*Lightning Arresters.*—While there is nothing that will protect electrical apparatus from a direct stroke of lightning, still means have been provided to protect apparatus from discharges occurring in its vicinity. It is customary to protect transmission lines by installing ground wires at repeated intervals along their course. One method much in use is to run a wire from the top of the transmission pole to the ground. Such wires are installed every few poles. Charges, due to lightning occurring in the vicinity of the pole line, discharge themselves over these wires into the ground in preference to traveling along the transmission line, entering the station, and destroying the generating or the receiving apparatus. As lightning frequently oscillates with a very high frequency, a few turns in the transmission wire is sufficient to impede the discharge of the lightning and make it tend to seek another path. An auxiliary path to the ground is often provided, this path being composed of a number of spark gaps in series. These gaps are traversed very easily by the high potential of the lightning and are sufficiently far apart to prevent the line potential from discharging to ground. A device of this character is termed a lightning arrester. When the lightning has broken down the gaps of a lightning arrester, there is a tendency for the line potential to continue the discharge through this path. To prevent this, one half of the gaps are shunted by a reactive coil. The induction of this coil is so adjusted that the lightning will jump the gaps, shunting the coil in preference to flowing through the coil. The line potential, however, of much lower frequency and lower

potential than the lightning, passes through the coil in preference to jumping the gaps. The result of this current flowing through the coil is to produce a magnetic field of sufficient intensity to extinguish the arc across the gaps and to restore the line to normal conditions of operation.

*Central Station Economics.*—It is desirable to reduce the initial cost of the production of electric power to a minimum wherever fuel is expensive and natural sources of energy, such as water-power, are absent. Such conditions are met with in many of our large cities. This reduction is accomplished by installing engines and generators of the highest efficiency, and by employing all methods which will tend to increase the efficiency of the plant. One of these methods is to directly connect the armature of the generator to the shaft of the engine. This eliminates the friction losses which would occur if belting were employed, but necessitates good speed regulation, as the pressure of a generator is directly proportional to the speed with which it rotates. It is essential for good service that the speed be regulated to within 1 per cent, otherwise lights will flicker and their use will be objectionable. Sometimes in large electric lighting systems the voltage of a given part of the system may vary as much as 5 per cent, but this variation is not continuous, and is due more to the local loading of the mains and not to the generator at the central station.

Throughout the western part of the United States much use is made of water-power for generating purposes. Power houses are situated in the bottom of ravines and are operating under heads of water as great as 2,000 feet. The famous Colgate plant on the Yuba River has transmitted power 253 miles, the longest electric power transmission in the world. Although the cost of water is small compared with the cost of coal, still the cost of electric power generated from water is not much cheaper than when generated from coal. This is due to the fact that the initial investment in a water-power plant is much greater than in a steam plant of the same magnitude. Much capital must be spent in the construction of expensive dams, waterways, and pipe lines.



*Direct Current Transformers.*—One of the greatest advantages of electrical energy over other forms of energy is its flexibility. It may be generated in one place, and its pressure may

## DYNAMOMETER — DYSENTERY

be transformed from a low voltage to a high voltage. The electrical energy in this form may be transmitted to a distant place where the reverse transforming process occurs. The higher the voltage under which power is transmitted, the smaller need be the cross-section of the transmission line. A stationary static transformer operating upon the principle of induction, is all that is essential to transform alternating currents, but with direct current transformation, it is necessary to employ rotating apparatus. It is not considered good engineering practice in the United States to use direct current for transmission purposes. Alternating current is used for this purpose and direct current is employed for distribution. Several machines have been designed which will transform direct current from one voltage to another voltage. They are termed motor-generators, dynamotors, and boosters. A motor-generator consists of a motor and a generator coupled together upon one shaft. The speed of the motor may be varied, which will correspondingly alter the voltage generated by the dynamo. A dynamotor consists of two armature windings upon the same core, rotating in one field. The armature has two commutators, one at each end of the shaft. This type of machine has practically no armature reaction and therefore has a small tendency toward sparking. The main disadvantage of this machine is that it is impossible to vary the field strength for purposes of regulation without correspondingly altering the voltage of the dynamo. A booster is a machine used extensively to raise the potential of railway feeders. Its armature is usually placed in series with the feeder and driven by some external source of energy. When its field coils are in series with the line, it is termed a series booster, and when the field coils are connected in multiple it is called a shunt booster. The capacity in watts of a booster is determined by the product of the feeder current into the maximum change of voltage which it causes. See also **ELECTRICITY** and kindred articles.

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**Dynamom'eter** (Gr. "power-measurer"), an appliance for determining the force required to overcome a given resistance. It is constructed in the most varied forms, according to the nature of the problem to be solved. A tension-dynamometer, such as might be used for measuring the force required to tow a vessel, is usually constructed on the principle of the steel balance, the tension that it is to measure being caused to compress (or elongate) a steel spring, whose deformation is observed by means of an index and scale, or continuously recorded by means of a pencil upon a drum that is revolved by clockwork. Dynamometers for measuring the torsional force transmitted by a shaft are commonly made by cutting the shaft in two, and uniting the separate but adjacent ends by means of a coupling which permits one of the ends of the shaft to rotate somewhat, relatively to the other end, the relative motion being opposed by a spring in the coupling, whose extension measures the twist that is communicated through the coupling. The commoner forms of dynamometer measure force, and not power. To determine the horsepower that a given apparatus is transmitting, it is necessary to know the velocity with

which the resistance is overcome, as well as the magnitude of the resistance itself. In ordinary work the velocity is observed separately, and the horsepower inferred by computation; but instruments known as "integrating dynamometers" are used to a limited extent, the computation being performed by these instruments automatically, somewhat as the area of a curve is computed by the planimeter.

**Dynamotor.** See **MOTORS AND DYNAMOS.**

**Dyne**, *din* (Gr. "power"), the unit of force in the centimetre-gram-second system of units. It is defined as the force that must be exerted upon a gram of matter for one second, in order to give it a velocity of one centimetre per second. The attractive force that the earth exerts upon a milligram of matter is somewhat different in different latitudes, but it may be said, for the sake of illustrating the order of magnitude of the dyne, to be about 1.02 dynes. For many purposes this is too small a unit for convenience, and a larger unit, called a "megadyne" and defined as equal to 1,000,000 dynes, is often used in its place. To the same degree of approximation as before, the attraction that the earth exerts upon a kilogram of matter may be said to be equal to 1.02 megadynes. See **UNITS.**

**Dy'nograph**, an apparatus used in modern railroading for testing the inequalities in the road-bed or track. It consists of a recording instrument mounted in a car and geared to the wheels thereof. An automatic pencil records the slightest roughness or inequalities, and locates them. The dynograph is in use on all the great railroads.

**Dy'renforth, Robert St. George**, American patent lawyer: b. Chicago 17 Oct. 1844. His early education was in the public school, but he finished it in Prussia where he began studying in 1857, and was graduated at Breslau in 1861. He took a degree in the Karlsruhe Polytechnic School after a course in mechanical engineering; he also was graduated at Heidelberg in mathematics, physics, and chemistry (1866-9). During the Civil War he served on the staffs of Gens. Rosecrans, Copeland, and Dodge. He entered the United States Patent Office 1871, resigned on Cleveland's election in 1885, and has since practised as a patent and corporation lawyer.

**Dyrrhachium**, *dīr-rā'kī-um*. See **DURAZZO.**

**Dysart**, *dī'zārt*, Scotland, a seaport in the county of Fife, on the Firth of Forth; 12 miles northeast of Edinburgh. Dysart possessed great importance in the 15th century, and was famous for collieries and salt-works. The trade is still of importance. Pop. 3,022.

**Dyscrasia**, *dis-krā'sī-ā*, or **Dyscrasy**, in pathology, a generally faulty condition of the body; an unequal mixture of elements in the blood or nervous juice; a distemperature, when some humor or quality abounds in the human system.

**Dys'entery**, a general term connoting a series of diseased conditions of the large intestine or colon (q.v.) These may be of an infectious, nervous, or chronic inflammatory origin. At the present time, it is becoming recognized that most cases of dysentery are due to some form of micro-organism, and, within

## DYSLYSIN — DYSPEPSIA

recent years, a bacillus has been described by a Japanese observer, Shiga, which is thought to be responsible for a number of the cases of dysentery, both in adults and in children. Certain mild cases of dysentery have been shown to be dependent upon the pernicious activities of certain bacteria belonging to the genus *Proteus*. And it has now been known for a long time that a certain lowly organized animal form, the *Amœba*, can induce a peculiar type of dysentery known as amœbic dysentery.

The general mode of onset of dysentery of the non-amœbic form, that is particularly epidemic dysentery, is rapid, with diarrhoea following perhaps a mild constipation or alternating constipation and diarrhoea with a mucous or serous discharge. Symptoms of indigestion frequently precede the attack, and it is characteristic that diarrhoea is accompanied with much wind. The fecal movements are large, loose, very fetid and usually mixed with blood and mucus. The movements are accompanied with great pain of a colicky or grippy nature. Tenesmus, or straining, is a very frequent symptom. There is usually much general pain, some rise in temperature, loss of appetite, nausea, restlessness, and irritability. In favorable cases formed feces commence to reappear in the stools and there is disappearance of the griping and straining. In the patients in whom the disease becomes more acute, the passages become looser, watery, slimy, and of a dark red color. The odor is mawkish, and in later stages may even become putrid. The fluid that is passed consists largely of an albuminous serum with epithelium blood cells, pus cells, tissue fibres, and small sloughs, and if the disease becomes even more pronounced the stools become dark brown in color, with sloughs and blood clots, and have a distinctly gangrenous odor. These sloughs from the intestine usually indicate an extremely severe form of the disease and oftentimes the patient dies with completely relaxed anus, with subnormal temperature, shrunken features, and in complete collapse.

Amœbic dysentery is, as a rule, a more gradual form of disease. It is extremely intermittent in its course and much protracted, running on sometimes months and even years. It very frequently begins with painless diarrhoea, alternating with constipation; the stools being loose and yellowish, containing much mucus and a little blood. The patient commences to lose flesh, becomes weak and anæmic, and the complication of abscess of the liver is extremely common. Chronic dysentery is a form of chronic colitis and can be found under that head. The treatment of dysentery consists in rigid hygiene and skilled medical attendance. See AMŒBA; CHOLERA; COLITIS; ENTERITIS; ENTEROCOLITIS; INTESTINES; PARASITES.

**Dys'lysin** (Gr. "hard to dissolve"), an amorphous, resinous substance, having the formula  $C_{24}H_{40}O_3$ , and obtained from cholic acid by heating to about 600° F., or by prolonged boiling with dilute hydrochloric or sulphuric acid. It is soluble in ether, slightly soluble in boiling alcohol, and insoluble in water; and it is reconverted into cholic acid by boiling with an alcoholic solution of caustic potash. It is occasionally found in feces.

**Dysmenorrhœa**, dīs-mēn-ō-rē'ā, painful menstruation. To constitute dysmenorrhœa, the

pain accompanying menstruation should be very distinct and persistent. Inasmuch as dysmenorrhœa is found accompanying a vast variety of abnormal conditions of the uterus and ovaries, it seems not improbable that this affection has no settled pathology, but may be associated with almost any abnormal condition within the generative apparatus of women. A vast variety of forms of dysmenorrhœa have been described, the most important of which seems to be that of obstructive dysmenorrhœa, or a mechanical form supposed to be due to some interference in the escape of the menstrual fluid. Those who suffer from dysmenorrhœa are apt to be anæmic, which anæmia in itself may be a sufficient cause for the disease. They are apt to be extremely nervous and run down. Treatment, therefore, should be directed to the supplying of the deficiency of the iron in the blood to overcome the anæmia, and the use of cod liver oil and other reconstitutives. Of the various drugs that have been used for the treatment of dysmenorrhœa those that relax muscular fibres and arterial walls seem to give the best results. This is true of a number of the newer synthetic drugs that have been employed very widely of late. As no two cases of dysmenorrhœa are due to precisely the same cause, general directions for treatment would be out of place in a work of this character, but rest in bed, free movements of the bowels, and hot water in the form of hot-water bags, or hot-water enemata, are very useful household remedies. See MENSTRUATION; OVARY; WOMB.

**Dyspep'sia** is that combination of symptoms that result from interference with the proper digestion of food in the stomach. Because of the taking of too much food, or unsuitable food, the mucous membrane of the stomach becomes irritated and there is set up an acute or subacute gastric catarrhal condition which prevents the proper digestion of the food. This food is apt to ferment and to decompose, and as a result, the familiar picture of acute dyspepsia may arise. In mild cases there may be nothing more than an uncomfortable feeling in the stomach, with a certain amount of depression, headache, loss of appetite and perhaps belching of wind and occasionally vomiting. There may also be accompanying intestinal symptoms, such as diarrhoea and colic, particularly in children. There may be only the familiar heartburn, due to the over-dilatation of the stomach, from the excessive gases of fermentation or putrefaction. In the more severe cases, those that last over a day or two, the symptoms enumerated may be much more intense. The distress may be marked, and the general constitutional symptoms more evident. Vomiting, loss of appetite and mental depression are much more pronounced. This is particularly true of acute gastritis, due to the excessive use of alcohol.

Very frequently, from continued errors in diet, the acute or subacute condition may become chronic so that there is a continual indigestion. Here the symptoms persist for an indefinite period, the appetite is very apt to be variable, although at times very good. Oppression after eating, which may amount to actual pain, is one of the most constant symptoms. Occasionally the pain may be pronounced when the stomach is empty. Heartburn is frequent, if not constant, the stomach is painful on pressure, the

## DYSPHAGIA — DZUNGARIA

tongue is coated, there is bad taste in the mouth, there are changes in the amount of salivary secretion. Frequent belching of gas is a very common accompaniment of chronic dyspepsia, particularly of the flatulent variety. Here also the intestines suffer from distention. Nausea is more pronounced, particularly in the morning hours, and vomiting is common in the morning. Constipation is usually present, although diarrhoea may alternate with constipation, and mental depression is almost characteristic. The treatment of acute and chronic dyspepsias constitutes one of the most difficult problems in modern medicine, particularly as few patients are willing to undergo the ordeals of a rigid dietary regimen. Most cases of dyspepsia can be cured if the diet is looked after, although each case needs careful consideration from the standpoint of causation. Proper eating and proper amounts of food are the two most important features in the treatment. Most people eat too fast, and eat too much. If the food is taken slowly, observing the old-fashioned rules of counting between mouthfuls and small amounts are taken, many patients suffering from indigestion can treat themselves with success. As to the details of the dietary and as to the medicinal treatment of the condition, medical advice is absolutely necessary. One of the most pernicious of all practices in the treatment of dyspepsia is the taking of many of the patent medicines which are so blatantly advertised in the religious and lay press. As most of these so-called tonics are hardly more than alcoholic beverages, it is evident that their use is not unattended with a great deal of danger. The treatment of the constipation that is so frequent an accompaniment of chronic dyspepsia by means of the many patent pills, powders, teas, and liquids is positively suicidal. See CONSTIPATION; ENTERITIS; GASTRITIS.

**Dyspha'gia.** See SWALLOWING.

**Dyspho'nia**, roughness of sound; in pathology, a difficulty in speaking. The disorder known as "clergyman's sore throat" is a common example. Rest of the vocal organs, tonics, muscular exercise, change of scene, are generally needed to aid recovery.

**Dyspnea**, disp-nē'ā. See RESPIRATION.

**Dys'trophies.** See MUSCLES.

**Dysuria**, dis-ū'ri-ā, difficult or painful urination, a symptom of temporary disorder, a deep-seated disease. When dysuria is merely the result of a slight cold it can often be relieved by a dose of sweet spirits of nitre, or linseed tea.

Sometimes this symptom is the result of a stricture, or it may be caused by gravel, or stone, in which case the services of a physician should be obtained, and that without delay.

**Dyveke**, dü'vë-kë, mistress of Christian II. of Denmark: b. Amsterdam 1491; d. by poison 1517. She was the daughter of an innkeeper at Bergen, and Christian met her for the first time in the inn of her father. She accompanied the king to Denmark in 1507 and was constantly with him for the 10 years following. She is one of the most romantic figures in Danish history, and has frequently been celebrated in poetry and fiction as the victim of royal passion, and the insane jealousy of the nobility, who resented her exaltation.

**Dzeren**, dzë'rën, the "goitred" yellow antelope of China (*Gasella* or *Procapra gutturosa*), with unusually pale horns, and a protruding, goitre-like crop. It is indigenous to the deserts of central Asia, China, and Tibet, and is noted for its fleetness. The name "dzeren" is Mongolian.

**Dzhol**, the Arabian Saturn.


**Dzierzkowski**, tsërts'köf-skë, **Joseph**, Polish novelist: b. Xaverov, Galicia, 1807; d. Lemberg 13 Jan. 1865. Among his works are: 'Salon and Street' (1847); 'The Twins' (1854); 'The Jugglers' (1855); 'The Crown of Thorns' (1856); 'Polish Chivalry' (1858), a historical novel; a drama, 'The Spark of Poesy' (1860).

**Dziggetai**, dzig'ge-ti, the native name for the Mongolian wild horse or wild ass (*Asinus* or *Equus hemionus*), also known as the Kiang (q.v.), and sometimes confounded with the Kulan (*Equus* or *Asinus onager*).

**Dzoha'ra**, the Arabian Venus.

**Dzungaria**, dzoon-gä'rë-ä, **Ili Proper**, or **Thian-Shan-Pe-Loo**, an extensive territory in central Asia, the boundaries of which are not very well defined. Dzungaria was originally the independent empire of the Dzungars, a branch of the Mongols, but about 1754 the territory was subjugated by the Chinese, under whom it remained till about 1864, when a rebellion broke out, and the Chinese settlements in Dzungaria were completely destroyed. A period of anarchy followed, which was not put an end to till July 1871, when Kuldja was occupied without opposition by the Russians. Since then the greater portion of Dzungaria has remained in the hands of the Russians, the rest being again under Chinese rule.

# E

**E** the fifth letter of the English alphabet, as also of the alphabets of Greek and Latin, and of all the European languages except those which, as the Russian, use the Cyrillian alphabet, where the E has sixth place. The character corresponding to E in Hebrew and other Semitic languages, as Phœnician, Samaritan, Chaldean, holds the same relative place in the alphabets of those languages. The form of the letter *he* in early Hebrew and early Phœnician was  and from that is derived the Greek Ε (epsilon), which is the Phœnician character reversed, with stem shortened and made perpendicular: this character represented in the Hebrew and other languages of western Asia, not the vowel sound E but the soft breathing. Taken into the Greek alphabet it was at first used to represent the vowel sound *e* whether short or long; but afterward the character Η was employed in Greek for the long *e* and was called *eta*, while the Ε received the name *epsilon*. The Latins used the E for both the long and short vowel and adopted the Η of the Greek alphabet to denote the aspirate. The name and sound of this letter in all European languages except English is *eh*, as in our interjection of inquiry: long *e* in those languages is invariably equal to *a* in *mate*, and short *e* equal to *e* in *met*: the long E of English is in those other languages expressed by the third vowel, I: thus, English *he*, *me*, *lee*, would in those languages be written phonetically *hi*, *mi*, *li*. In the standard alphabet employed in linguistic science the vowels *a*, *e*, *i*, *o*, *u*, are taken to represent the sounds *ah*, *eh*, *ee*, *oh*, and *oo*, and are named accordingly. The letter E occurs in English words far more frequently than any other letter of the alphabet: compared with A, I, O, U, its frequency of occurrence is as 1,000 to 728, 704, 672, 296 respectively; compared with various other letters it is as 1,000 to 770 (*t*), 670 (*n*), 392 (*d*), 280 (*c*), 236 (*f*), 120 (*b*), 22 (*s*). In frequency of occurrence as an initial letter it ranks only as eleventh and is to T as 340 to 1,194. One reason of the greater frequency of E in general use is that it often takes the place, in modern English words, of the vowels *a*, *o*, and *u* of Anglo-Saxon words; another reason is that final *e* is largely employed to lengthen the vowel of a preceding syllable, as in *there*, *here*, *cape*, *paine*: it is employed even where it serves no purpose of pronunciation at all, as in *gone*, *live*, *give*.

E as an abbreviation is used for *East*, *editio*, *emeritus*, and *ergo*; *e. g.* and *e. c.* for *exempli gratia*, and *exempli causa*.

In music E is the third tone in the key of C, and the fifth semitone in the chromatic scale.

**E. C. Sporting Powder** is a superficially hardened, soft-grained, smokeless sporting powder, consisting, according to an analysis by C. E. Munroe, of 53.57 per cent of soluble cellulose nitrate, 1.86 per cent of insoluble cellulose nitrate, 3.12 per cent of unconverted cellulose, 34.26 per cent of barium nitrate, 4.55 per cent of potassium and sodium nitrates, 1.17 per cent of volatile matter, and 0.55 per cent of aurine, the latter being an organic coloring matter, used to impart an orange color to the grains. The manufacture, as carried out by the Explosives Company, after the method invented by Reid and Johnson, consisted in placing the moistened, pulped cellulose nitrates and metallic nitrates in "barrels" where, by rotation, the ingredients were mixed and then broken up into rounded grains, which were dried and then sprayed with ether-alcohol which at first gelatinized the surfaces of the grains, and then by evaporation left a hard skin about the grains. The coloring matter was added in the solvent.

**E Pluribus Unum**, ē ploo'rī-bus ū'nūm ("one from many"), the motto of the United States; chosen for its Great Seal 10 Aug. 1776, by Franklin, Adams, and Jefferson, as a committee. It has been part of the motto of the 'Gentleman's Magazine,' founded 1731; apparently taken by it from a sentence in Virgil's (?) 'Moretum,' "color est e pluribus unus."

**Eachard, John, D.D.**, English clergyman: b. Suffolk, England, 1636; d. Oxford 7 July 1697. He became a Fellow of Catherine Hall, Cambridge, in 1658, and master in 1675. His writings include: 'The Ground and Occasions of the Contempt of the Clergy and Religion Inquired Into' (1670), and a 'Dialogue on Hobbes's State of Nature' (1672). He was a writer of considerable humor, but of no great ability.

**Eadie, Ed'ie, John**, Scottish religious writer: b. Alva, Stirlingshire, 9 May 1810; d. Glasgow 3 June 1876. He wrote on theology with great vogue among the unlearned; his books including: 'The Divine Love' (1855); 'Paul the Preacher' (1859); etc.; in addition to scholarly treatises and commentaries.

**Ead'mer, or Ed'ner**, a mediæval churchman, historian of his own times and biographer: he flourished in the 11th and 12th centuries, dying at Canterbury about 1124. He was a Benedictine monk and was the companion, counselor, and friend of St. Anselm, Archbishop of Canterbury, whose life he wrote. He held a like relation to St. Anselm's successor, Radulphus, or Ralph, till 1120 when, invited to Scotland by King Alexander I., he was nominated bishop of St. Andrews; but went

back to his monastery because of a controversy having arisen over the king's right to nominate and the pretensions of the archbishops of Canterbury to primatial jurisdiction over the bishops of Scotland, which pretensions Eadmer upheld. He was even wont to say that he would refuse the highest see in Scotland if he must divest himself of his character as a monk of Canterbury. He wrote 'Historia Novorum,' that is, history of recent occurrences of his own times. Besides the life of St. Anselm he wrote the lives of three of Anselm's predecessors in the primatial see—St. Odo, St. Dunstan, and St. Bregwyn; also the lives of St. Wilfrid, and of St. Oswald of York; all of which writings have been printed.

**Eads, ãdz, James Buchanan**, American engineer: b. Lawrenceburg, Ind., 23 May 1820; d. Nassau, New Providence, 8 March 1887. He early designed some useful boats for raising sunken steamers, and in 1861, when called to advise the Federal government, constructed within 100 days eight ironclad steamers for use on the Mississippi and its tributaries. He afterward built a number of other ironclads and mortar-boats, which were of considerable service to the North. He built an arch bridge across the Mississippi at St. Louis. (See **EADS BRIDGE**.) His works for improving the South Pass of the Mississippi delta were successfully completed in 1875-9; and his great plan for deepening the river as far as the mouth of the Ohio by means of jetties has been demonstrated to be entirely practicable. A later suggestion, for the construction of a ship-railway across the Isthmus of Tehuantepec, attracted much attention. In 1884 he received the Albert Medal of the Society of Arts, being the first American citizen to whom this honor had been awarded.

**Eads Bridge, The**, so named after its chief engineer, Capt. Jas. B. Eads (q.v.), is the great steel arched bridge over the Mississippi River at St. Louis, Mo. It has three spans, the central being 520 feet in the clear, and the side spans 502 feet. The rise of the central arch is 47½ feet. Each span consists of four steel ribs carrying two railways and a broad highway for teams, street-cars and pedestrians.

The bridge is remarkable chiefly in four respects: (1) The depth and size of the foundations and piers. (2) The method employed in sinking the piers. (3) The novel construction of the arched ribs. (4) The method of erection.

1. All four of the great piers stand upon the bed-rock far below the ordinary bottom of the river. The eastern river-pier extends 126½ feet below extreme high water, with a total height to the upper roadway of 199¼ feet. Its base is an elongated hexagon, 82 feet long by 60 feet wide. The east abutment pier has a larger base and a depth below high water of 134½ feet. These depths were beyond all precedent.

2. The deep piers were built upon hollow iron caissons which at first floated upon the water, and which later during the sinking were supported by the friction of the loose sand which formed the river bed, and by the compressed air in the chambers of the caissons. All the masonry was laid in the open air at or near the level of the water. The sand below the caissons

was removed by an ingenious device known as the sand pump (q.v.), invented by Capt. Eads. The difficulties encountered and overcome in sinking the piers to the rock, and in working men under several atmospheres of compressed air—form most valuable chapters in the history of bridge engineering. The air chambers were finally filled with concrete so that the piers now stand solid masses of masonry.

3. Each of the arched ribs consists of two parallel series of steel tubes, one above the other, and 12 feet apart. The tubes are 18 inches in diameter and about 12 feet long, with their ends slightly beveled so that they follow circular arcs. A tube is formed of six bars of steel inserted in a steel envelope one fourth of an inch in thickness, like staves in a barrel. Sleeve couplings and heavy braces give every rib the strength and rigidity of a continuous mass of steel. The first or springing tubes, which are very thick, are screwed into wrought-iron "skew-backs" which are fixed to the masonry by three or four steel (or wrought-iron) bolts 6¼ inches in diameter, and from 24 to 34 feet in length. Under moving loads and changes of temperature the tubes are alternately subjected to tension and compression. These arched ribs with tubular members are unique in engineering history and were the result of a vast amount of study and experiment. In construction they were very expensive.

4. The bridge was erected over a deep and rapid stream without centring and without interfering with the river traffic. The fixed end of a rib made it self-supporting while it was built out from above to about 100 feet; it was then supported by cables passing over the pier and over a temporary tower standing on the pier and by a secondary cable until the centre of the span was reached.

Recent investigations have found the bridge sufficiently strong for the heaviest locomotives and trains. When tested publicly 14 locomotives stood upon each span. Capt. Eads designed the piers, the arched ribs and the method finally adopted for closing them. Charles Pfeifer developed the mathematical theory of the arch, which was finely elaborated by Prof. William Chauvenet. The method of erection was devised by Col. Henry Flad, who gave to the whole work continued study and supervision.

Work on the bridge was begun in 1867 and finished in 1874. The cost of the bridge was about \$6,500,000. The difficulties, financial and physical, were many and great. Over 600 men were prostrated by the compressed-air work, and 13 died. The complete story with the "Theory of the Ribbed Arch" is told in 'The History of the St. Louis Bridge,' published in 1881 by the writer of this sketch. See **BRIDGE**.

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**Eagan, Charles Patrick**, American military officer: b. Ireland January 1841. In 1862 he entered the Union army as first lieutenant; in 1874 was promoted captain and commissary of subsistence; in 1892, major; in 1897, lieutenant-colonel; on 11 March 1898, colonel, and on 3 May, following, brigadier-general and commissary-general. In January 1899, he made remarks concerning Gen. Miles. In his testimony before the War Investigation Commission, for



## EAGLE

which he was tried by court-martial and sentenced to dismissal from the army. His sentence was commuted by the President to suspension from duty and honors for six years. On 6 Dec. 1900, he was restored to duty and immediately afterward retired.

**Eagle, James Phillips**, American Baptist clergyman: b. Maury County, Tenn., 10 Aug. 1837. He was educated at Mississippi College (1870). He served through the Civil War as a Confederate in all grades from private to colonel. In the close of the War he became a Baptist minister and cotton planter in Arkansas; has been elected four times to the Arkansas legislature, served one term as governor of the State, and for years has presided over the Baptist State Convention.

**Eagle**, as a popular name includes several raptorial birds which vary in some respects from the strictly defined group in which science has been wont to place it. The order *Accipitres*, to which it belongs, is broad enough in definition to include all the vultures, the typical eagles, and the buzzards. Recent osteological demonstrations, however, have led to the separation of American vultures from the Old World vultures, including the latter in the family *Falconidae*, to which eagles and vultures belong. This family, which embraces 300 species of diurnal raptors, is characterized by imperforate nostrils, legs of medium length, and, except in the Old World vultures, a feathered head, a bill decidedly hooked, the hind toe inserted on a level with the three front ones, and the claws roundly curved and sharp. The subfamily *Aquilinae* makes prominent the cutting edge of the upper mandible, the bony shield over the eye, the feet heavy and short, either scutellate or feathered. The Lämmergeier (*Gypaetus barbatus*), lamb-killer, or bearded vulture of the Alps, the Pyrenees, and the Himalayas, finds its nearest affinity here. The *Aquilinae* are naturally divided into two genera: *Aquila*, land eagles, and *Haliaeetus*, sea-fishing eagles. The former is feathered to the toes, the latter half way to the toes.

The leading specimen of *Aquila* is the golden eagle (*A. chrysaetus*) one of the largest and most magnificent of its kind, dark brown with purple gloss; head and neck brownish-yellow; tail rounded and dark brown, ending in light and dark tints. The length is about three feet, the extent of wing seven feet. In North America its range is from Mexico north. It is very scarce in the United States but more abundant in Canada, where it is distinguished as *canadensis*. It is regarded as a variety of the European species, which seldom occurs in England, though more prevalent in Scotland, where the demand for its eggs has favored its increase. The nest is usually placed on some inaccessible cliff, the eggs are spotted and do not exceed three. Closely allied to the golden eagle are the imperial eagle (*A. mogilnik*) of southwestern Europe and of Asia, and the king eagle (*A. hiliaca*) of the same range. The smallest of the kind is the dwarf eagle (*A. pennata*) which measures less than two feet and is native in Southern Europe, North Africa and in India.

First in interest among the sea-eagles stands the bald-headed eagle (*Haliaeetus leucocephalus*), selected as the national emblem. Its markings are familiar, though the term "bald" is to be

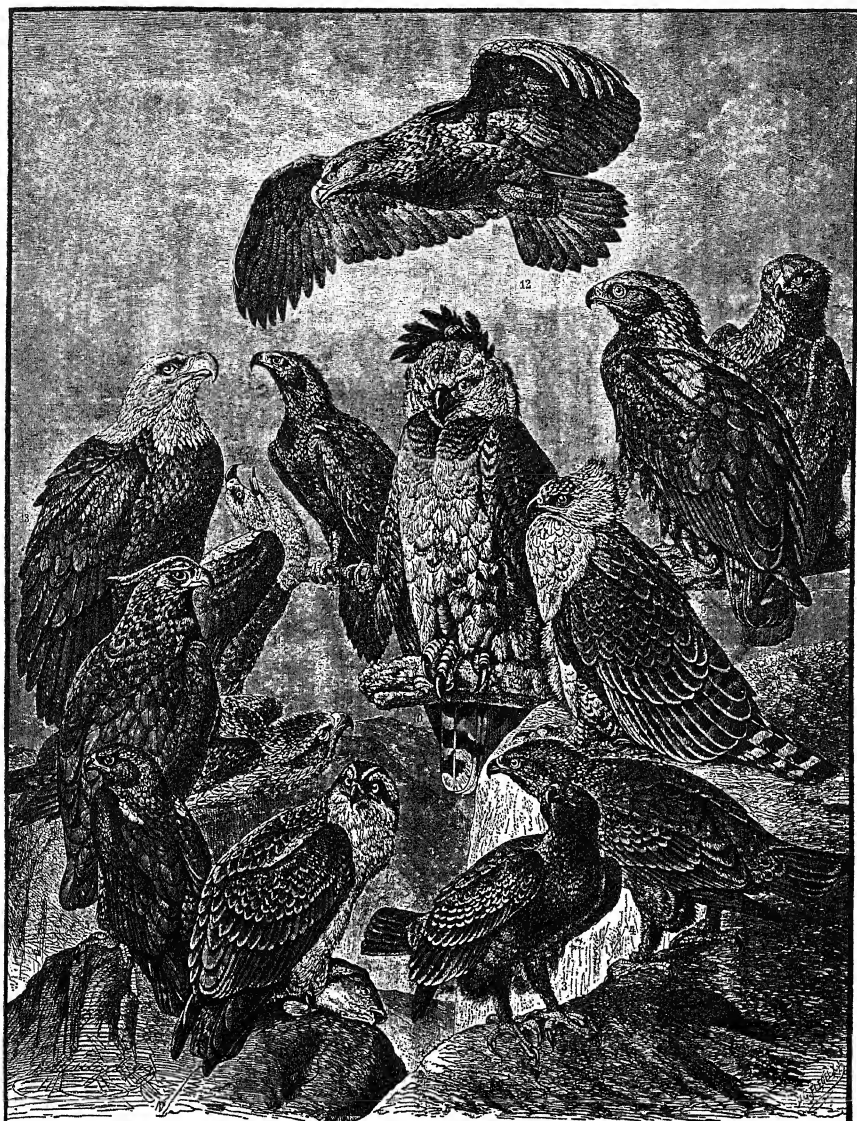
referred not to the absence of feathers, but to the effect produced by the white feathers on the head. In size, it corresponds nearly to the golden eagle, but it differs in its habits, living mainly upon the fish which it seizes along the sea-shore and around lakes and rivers. The nest is built on a high tree top or upon a rocky cliff. A finer specimen than this is the northern sea-eagle (*Haliaeetus pelagicus*) of northeastern Asia. It is conspicuous by its large form and bill, and by the contrast of its main color, brown, with the white of its shoulders, rump and tail. The African sea-eagle (*H. vocifer*) is a fish-eater, about half the size of the "bald-head," remarkable for its color-markings, being white on the head, neck, and breast, while the under parts and wing coverts are chestnut, and the upper parts are black or brown. Nearly related to the *Haliaeetus* is the fishing-eagle (*Polyoetus ichthyaeetus*) of India and the East Indies, with extremely curved talons, and living entirely on fish. In countries bordering on the Mediterranean and ranging into India and Central Europe, is the serpent-eagle (*Circaetus gallicus*) with short toes, white, brown-spotted under parts, and dark brown upper parts. It feeds upon reptiles, which it kills and carries away, not eating the game on the spot, as do other eagles. A buzzardlike genus, *Helotarsus*, is represented in Southern Africa by *H. caudatus*, the short-tailed eagle, ornamented with maroon and black plumage, and bright red, very short legs.

The buzzard-eagles include some species which command notice from their great size and powerful action which fairly entitle them to their name. South America, in the dense forests of the Amazon, is the habitat of the Guiana eagle (*Morphnus guianensis*) relatively small, but with a tail longer than that of almost any other species. The wings are short and rounded, adapting it to swooping down with great force upon its prey, rather than for lofty or prolonged flight. From southern Mexico through the forests of Brazil, the harpy-eagle (*Thrasaetus harpyia*) has its home, and for muscular power is scarcely surpassed by any bird of prey in the world. It is larger than the golden eagle, gray in color, with long crest feathers, a stout, vicious bill, and talons of extraordinary force and sharpness. Though rapacious and apparently destructive, the eagles are useful in killing many other birds which venture nearer to farms and human habitations, in reducing the number of injurious reptiles and small mammals, and in helping to preserve the balance of the animal world.

**Eagle**, a gold coin in the United States of the value of 10 dollars, or £2 1s. 8d. sterling, and weighing 258 grains troy, 900 fine. It was first coined in 1795, in accordance with an act of Congress, dated 2 Jan. 1792. There are also half eagles (first coined in 1795), quarter eagles (first coined in 1796), and double eagles (first coined in 1849), of proportionate values.

**Eagle**, in astronomy, name given to a northern constellation, from the bird supposed to have carried the thunderbolts of Jove. The constellation comprises stars of the first, second, and third magnitudes. The most important of these is Altair, star of the first magnitude, from which the moon's distance was once computed.

## EAGLES.



1. The Golden Eagle (*Aquila chrysaetus*).
2. The Black Eagle (*Aquila melanaetus*).
3. The Pomarine Eagle (*Aquila pomarina*).
4. The Oriental Eagle (*Aquila orientalis*).
5. The Dwarf Eagle (*Aquila pennata*).
6. The Wedge-tailed Eagle (*Aquila audax*).
7. The Striped Eagle (*Aquila fasciata*).

8. The Crested Eagle (*Spizaetus occipitalis*).
9. The War Eagle (*Spizaetus bellicosus*).
10. The Harpy Eagle (*Harpyia destructor*).
11. The Screech Eagle (*Haliaetus vocifer*).
12. The White-tailed Eagle (*Haliaetus albicilla*).
13. The Baldheaded Eagle (*Haliaetus leucocephalus*).
14. The Osprey (*Pandion Haliaetus*).



## EAGLE — EAMES

The name is also given to the standard carried by the ancient Roman legions. This standard consisted of a staff, with an eagle perched upon its extremity. A special band of men was appointed to precede and guard these eagles, which always led the army into battle. The French battle standard, in imitation of the Roman, is also surmounted by an eagle.

In heraldry a bearing of frequent occurrence, and often assumed by sovereigns as the emblem of empire from having been borne on the legionary standard of the ancient Romans. The United States, in 1785, adopted the bald eagle, its wings displayed, proper, as the national emblem. The eagle of Russia is *or*, with two heads, displayed, sable, each ducally crowned of the field; the whole imperially crowned, beaked, and membered gules. The eagle of Austria is also displayed with two heads. The Prussian eagle has only one head.

**Eagle, Black**, a term applied to the golden eagle, *Aquila chrysaetus*, also to the young of the bald-eagle. See **EAGLE**.

**Eagle, Black, Order of**, a Prussian order, founded by Frederick II. in 1701. The number of knights in the order is limited to 30, exclusive of the princes of the blood royal, and all members must be of unquestioned nobility. The badge is a cross of eight points having in the centre a circle with the monogram F.R. (for *Fredericus Rex*); the four arms are enameled red with the eagle of Prussia in black enamel between each two arms.

**Eagle Hawk**, or **Hawk Eagle** is the name for a group of some rather small and some large raptorial birds, closely related to *Aquila*, and chiefly represented by the genus *Spizaetus*. They are beautifully crested and range in South Africa, Central and South America. A notable specimen is the crowned eagle (*S. coronatus*) of South Africa, of medium size, its under parts buff, banded with black, the head furnished with a crest of long, brown feathers. Of the same geographical range is a species of *S. (Lophoaetus) occipitalis*, a small bird with a crest four inches long. In Central and South America are crested members of the group, *S. (Lophotriorchis) isidori* and *S. ornatus*.

**Eagle Owl**, an owl of the genus *Bubo* (family *Strigida*, horned owls, order *Accipitres*, represented in nearly all parts of the world except Australia. Of rare occurrence in Great Britain, it is common in the foot-hills of the Ural Mountains, and throughout Siberia as far as China. In the northern Old World *B. ignavus* is one of the largest owls, of unsurpassed strength and daring. The colors are black, brown and white, mottled. A grown specimen weighs about eight pounds and measures 26 inches from bill to end of tail; the wing is 18 inches long, and the plumage feathers, constituting the horns, are nearly 4 inches in length. It is the boldest and most ravenous owl, and is a match for the eagle. To the superstitious people of the north, its weird call-note sounded at night in the depths of the forest announces the presence of evil spirits. The great horned-owl of America (*B. virginianus*) bears a general likeness to its European congener, though smaller in length of body and wing. The colors are the same but differently arranged. The lower parts are barred rather than spotted, the breast and throat are marked with a large white patch, and a

black ring is stamped on the disk of the face. Like the European species, it preys upon hares, large ground birds, rats, mice, reptiles, and fish, and besides on the young of the American turkey.

**Eagle Pass**, Texas, town, county-seat of Maverick County; on the Rio Grande River; the Mexican I. and the S. P. R.R.'s; about 155 miles southwest of San Antonio. It is a trade centre for a coal mining and cattle section, and the shipping of cattle, hides, and wool is steadily increasing. It contains large brick and lumber yards. Pop. 3,200.

**Eagle Ray**, a fish of the order *Raia*, of which the torpedo and the sting-ray are familiar members, and associated with the sea-devil in the family *Myliobatidæ*. It is a flat fish with a very broad disk distinguished by pectoral fins which continue to the snout and then reappear at the extreme end of the head. The tail is long and slender like a whiplash. The teeth are flat for crushing crabs and for grinding shells. Though much smaller than the sea-devil, which is sometimes immense, the eagle ray often attains a considerable size. It brings forth its young alive, and inhabits tropical or subtropical waters.

**Eagle, Red, Order of**, originally called Order of the Red Eagle of Baireuth, and also called Order of Sincerity; founded by the Margrave of Baireuth in 1705. The badge is an eight-pointed cross, having in the centre a medallion with a red eagle bearing the arms of the Hohenzollern family.

**Eagre**, a Norse word signifying a formidable influx and surging of the tide, the same as *bore* in a river, as in the Severn and Houghly rivers and the Bay of Fundy. See **BORE**.

**Eakins**, êk'inz, Thomas, American artist: b. Philadelphia 25 July 1844. He was a pupil of Gérôme. He has been professor in several art schools, lecturing there on anatomy and painting. Among his works are many pictures of American domestic scenes, out-of-door sports, portraits and several large canvases, such as Dr. Gross and Dr. Agnew at their clinics. The colossal figures of the prophets, Witherspoon building, Philadelphia, were molded by him and his pupil Samuel Murray.

**Ealing**, êl'ing, England, town, and also a parliamentary division of Middlesex, the former a few miles west of London. The town has a free library, science and art schools, and a training college for teachers of the deaf. Pop. of town 23,979; of the parliamentary division 70,748.

**Eames**, êmz, Charles, American lawyer and journalist: b. New Braintree, Mass., 20 March 1812; d. Washington, D. C., 16 March 1867. He was graduated at Harvard in 1831, and began the study of law. After accepting a position in the navy department at Washington in 1845, he took editorial charge of the Washington *Union*. He was sent by President Polk as U. S. Commissioner to the Sandwich Islands, and afterward became United States minister to Venezuela, under President Pierce. Returning in 1858 he gained a great reputation as a lawyer in admiralty cases.

**Eames, Emma**, American operatic prima donna: b. Shanghai, China, 13 Aug. 1867. She studied music in Boston and Paris, singing in

churches and concerts in the former city, and making her début in grand opera, Paris, 13 March 1889, in 'Juliette,' appearing in grand opera at the Covent Garden, London, 1891, and in New York the same year, since which time she has been a popular member of grand opera companies in Europe and America. She married the well-known artist, Julian Story, 1891, and resides in Paris, France.

**Eames, Wilberforce**, American bibliographer: b. Newark, N. J., 12 Oct. 1855. He has long been prominent in bibliographical matters, having been assistant at the Lenox Library, New York, 1885; assistant librarian 1892; librarian 1893-5, when upon the consolidation of the Astor Library and Tilden Trust as the New York Public Library, Astor, Lenox and Tilden Foundations, he became librarian of the Lenox branch. He edited volumes 15-20 of 'Sabin's Dictionary of Books relating to America' (1885-92). Among his works are: 'Bibliographies of the Bay Psalm Book' (1885); of 'Ptolemy's Geography' (1886), and of 'Sir Walter Raleigh'; bibliographic notes on 'Eliot's Indian Bible' (1890), reprinted from 'Pilling's Indian Biographies,' and a bibliographic account of the early catechisms of New England (1898).

**Ear, Anatomy, Physiology, and Disorders of the.** In most of the animal creation the vibrations which we term sound have special portions of the body for their recognition, more or less precise; although in the lower forms every part of the simple organism can respond to them in some degree. The earliest separation of a distinct hearing-organ is seen in the *Medusæ*, of which the common nettle of the salt waters is a well-known example. Here we find certain of the tentacles covered with delicate cells having hair-like projections and enclosing a chalky concretion, the otolith (Fig. 1). This structure of a tiny vesicle with single or mul-

of fluid-containing sacs deserving the name of "labyrinth," in which chalky particles (often of special crystalline form) lie in close relation to "hair-cells,"—as we term these structures with their delicate prolongations. A nerve, more or less defined, passes to the sac (Fig. 3) and connects it with the sensory centres, which in the vertebrates and some of the higher invertebrates may be called brain-centres. This apparatus is in the vertebrates imbedded in the cartilage or bone on either side of the head; and in those creatures which do not live in the water, accessory apparatus

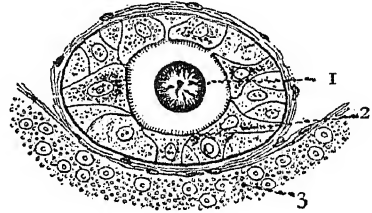


FIG. 2.—1. Otolith; 2. Hair-cells directed toward cavity; 3. Nerve-cells.

is present to help transmit the air-vibrations to the fluid ("endolymph") of the labyrinth. As we pass up the scale of animal life the organ of equilibrium is found in relation to that of hearing; and thus in the lowest fishes we find that the sac assumes a ring-form (Fig. 4) by reason of the formation of a semicircular canal with a pear-shaped widening or ampulla at either end. In these the nerve terminates in hair-cells without otoliths, while between these a larger portion of the sac receives the main nerve-supply at a prominent "macula" supplied with hair-cells and otoliths. A second and a third semicircular canal, each with its own ampulla and nerve, is found in the higher forms, and the main sac divides into two increasingly separate portions with separate nerve-supply. One of these portions communicates with the semicircular canals, while the other is connected with a tubular outgrowth, which in the highest forms coils into a spiral and is encased in a snail-shell covering, which gives it the name of "cochlea." The nerve passing to this becomes highly developed and the end-organ is greatly elaborated into an apparatus generally called after its discoverer, "Corti's organ." Around this essential apparatus more and more complex protective envelopes and spaces filled with "perilymph" have been developed, while accessory apparatus, called middle and external ear, have been formed to aid in the conduction of sound-waves to the percipient contents of the labyrinth.

The development thus roughly traced in the ascending scale of animals can be still more perfectly seen in the development from the ovum of the embryo of the higher forms. Here we see a portion of the external surface dip inward as a pit, become separated as a closed sac beneath the surface, undergo the elaboration described, secure nerve-connection with the brain and at such points of communication develop its hair-cells and otoliths. Originally a spherical sac, its complexity soon merits its name of labyrinth and this membranous laby-

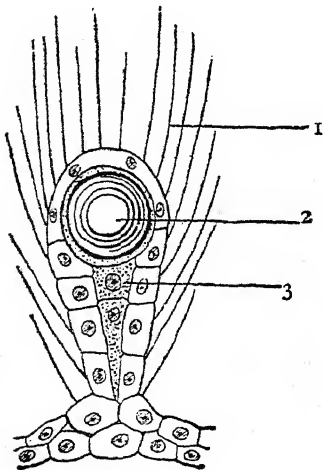


FIG. 1.—1. Hairs of the hair-cells; 2. Otolith; 3. Sensient (nerve) cells.

multiple otolithic contents (Fig. 2), connected with the more sensitive or distinctly nervous portions of the organism may be regarded as the fundamental form of the ear; as it develops, it takes on more and more complicated forms

## EAR

rinth gives form to a surrounding labyrinth of cartilage or bone, which has been longer known and studied.

Taking the human ear as representing that of all the higher vertebrates and as an elaboration of that of lower animals, we find an acoustic nerve emerging from each side of the pons or lower back part of the brain, to pass, in close association with the nerve giving motion to the face, into the stony-hard, innermost part of the temporal bone which encloses the ear, but may be paralyzed by involvement in tympanic disease. The facial nerve passes on through, and practically has but accidental relation to the ear. The acoustic nerve, containing nerves for the organ of equilibrium, divides and

tains the apparatus in form and elaboration meets most of the requirements of such a theory and its partial destruction by disease has caused loss of hearing for certain tones—low if the apex, high if the base, be injured.

Outside of the labyrinth or *percipient* apparatus we find a *conducting* apparatus of external and middle ear (Fig. 9). The outer ear is formed by the in-growth of a pit of the skin-surface to constitute an external auditory canal, around the edge of which gristly projections raise the skin-covering into the prominent but unimportant features to which the name "ears" is commonly applied. The inward growth of the canal brings its bottom into close relation with the middle ear, so that only a thin partition, the drumhead, intervenes. The middle-ear is an outward development of the mouth-cavity, which hollows out the tissues between the external and internal ears—forming the Eustachian tube as its inner portion, the drum-cavity or tympanum just within the drumhead at the bottom of the external canal, and other air-spaces, "mastoid cells," of less constant presence and form and of doubtful value, but notable because of serious disease-conditions to which they are subject. Two "windows" make communication between the internal and middle ear, both closed by membranes shutting in the fluids of the labyrinth—that closing the lower "round window" being called the secondary tympanic-membrane. The upper or "oval window" is occupied by the foot-plate of the stirrup-bone, which with the little hammer and anvil forms (Fig. 11) a compound lever between the drumhead and the labyrinth-fluids. This serves to increase the force while lessening the amplitude of the vibrations of the drumhead and thus aids the transmission of waves of sound, especially of low tones, from the air to the internal fluids. The lower animals move the external ears as an aid in locating sounds, but the muscles effecting this are rudimentary in man and the external ear can be lost with little recognizable impairment of hearing. More important, although of ill-determined working, are the muscles moving the little bones of the drum-cavity; one, the drumhead tensor, drawing in the hammer-handle and thus tightening

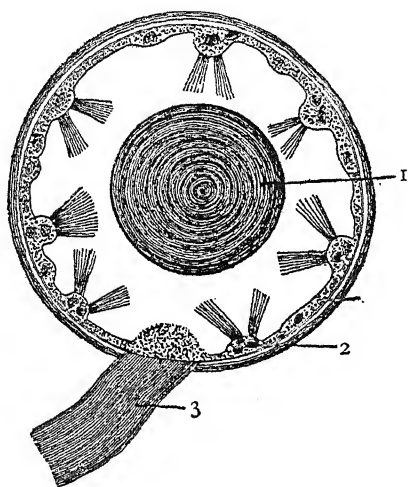


FIG. 3.—1. Otolith; 2. Hair-cells; 3. Nerve-trunk.

is distributed to the various parts of the labyrinth. At each point of its distribution cells with hair-like projections form end-organs through which impressions are received to be conveyed to the brain. Three of these points are in the three pear-shaped swellings of the semicircular canals, two are in the two vestibular sacs and the most elaborate enters the base of the snail-shell (Fig. 8), and is distributed to the highly elaborated organ of Corti, here located. This consists of a fairly orderly arrangement of hair-cells without otoliths, supported by curiously modified cells of like origin (Fig. 7), all resting upon a delicate "basilar membrane" narrowest below and broadest above, which winds spirally from the bottom to the top of the shell-like cochlea, and is formed of parallel transversely stretched fibres. Here we have an apparatus comparable to the strings of a harp or piano; and just as each string of a musical instrument can vibrate in accord with those attuned to it in another and can even repeat the tones of an inaudibly distant instrument with which it is connected by a wire; so there is much to support Helmholtz's claim that each fibre of the basilar membrane is a cord tuned to a certain pitch and vibrating responsive to any tone of that exact pitch which reaches it. This serves to excite a special hair-cell resting upon it and send a nerve-impulse along the ultimate nerve-fibril of which this forms the terminus. Cer-

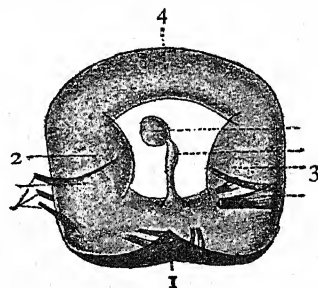


FIG. 4.—1. Acoustic nerve and macula in vestibular sac which communicates with (2) the anterior and (3) posterior ampulla of (4) the semicircular canal.

the drum-membrane to which it is attached, and one acting on the stirrup. Even the drumhead and chain of little ear-bones can be actually or virtually destroyed with preservation of a large part of the hearing: but their presence in damaged condition may be a serious obstacle to useful function by impeding sound conduction.



The upper and lower limits of human hearing are somewhat in dispute, but it is fairly safe to say that tones of 32 double vibrations per second and up through 10 octaves, should be audible to a healthy ear. If a cog-wheel touching a card or other elastic plate be turned with increasing speed the individual strokes or vibrations can be distinguished up to 16 per second;

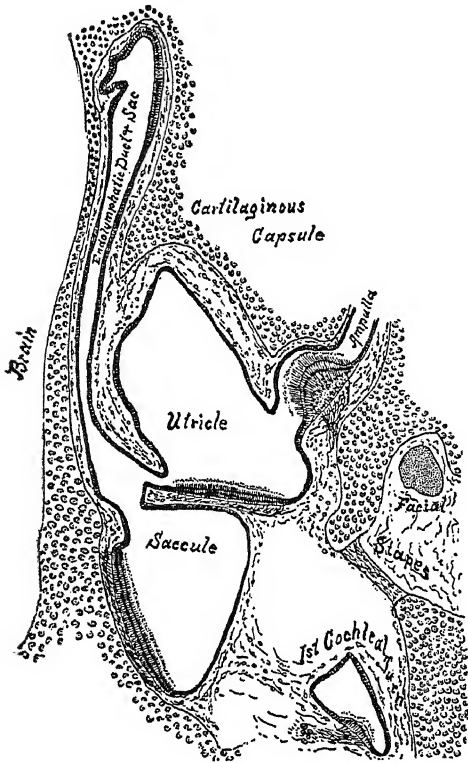


FIG. 5.—Developing labyrinth dividing into two sacs with separate areas of hair-cells.

then they blend and a continuous tone is produced; but the tone heard may be an overtone and not that of 16 per second as is often claimed. Through the thin young drumhead or one having an opening in it still higher tones can be heard, probably up to 55,000 vibrations; but age and disease easily effect changes which bar out these high and relatively weak tones; yet it is striking to note how well they may be heard by those deaf to ordinary speech. Those unable to enter general conversation by reason of impairment of the conducting apparatus may often hear the same voice readily over the telephone, which transposes it to a higher key; and some much-advertised hearing-helpers have their value as portable telephone lines. Human speech, the hearing of which is in civilized life the most important use of the ear, has a range from near the lowest limit of perception in the sound of R to some 4,000 vibrations per second in the sibilants S and X. We have in speech, therefore, with its easy gradations of intensity from faint whispers to loud shouts, a ready means of testing the hearing and mea-

suring its defects. Variable as are voices or even the same voice within its range, it constitutes our best practical test of the degree of deafness. Generally the faintest articulate whisper should be heard at arm's length and a loud "stage whisper" 50 feet or more. The numbers up to 100 make good tests if rightly selected and should be spoken clearly with the "reserve-air" which can be expelled from the lungs after an ordinary "tidal expiration"; and they should be repeated by the person examined in evidence that they have been correctly heard. The watch is a very variable, limited, and imperfect test, which may be ill-heard by ears otherwise perfect, well-heard by some with little useful hearing and imagined or falsely claimed to be audible when it is not, in a way not always easy of detection. All measurements of hearing for sounds or speech should be made with the eyes screened from seeing the approach of a sounding body or "reading the lips" as many deaf persons do most successfully, at times unconsciously. Medically, the best tests of hearing are by speech and by tuning-forks—the latter serving not only to measure the hearing or loss of it, but to locate the seat of trouble as a prime requisite to successful effort for recovery. A "continuous tone-series" of tuning-forks or other instruments may be used by the expert to test the entire ten or more octaves; and the aurist should always have several forks, although much may be learned with a single one. A fork of 200 to 500 double vibrations per second is the most useful and should be seven or more inches in length and weigh as many ounces: the latter is important as the loudness and duration of tone depend upon it. One of 30 to 50, and one of 2,000 double vibrations should also be used, while intermediate tones have value. The lower forks should have thickened ends or clamps or pieces of rubber-tubing on the tips

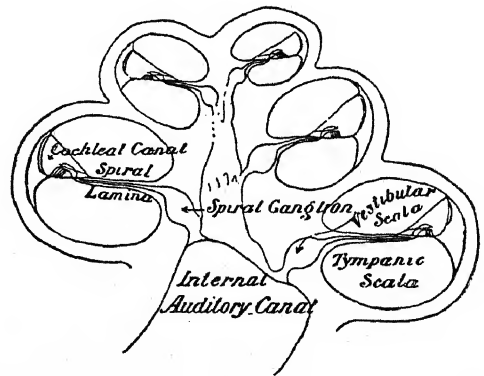


FIG. 6.—Diagram of the cochlea in section with the channels for its nerves and the perilymph spaces which surround the cochlear canal in its windings.

to damp the "over-tones," which may be heard by ears to which the fundamental note is inaudible. The fork should be struck by falling of its own weight through its own height upon a rather dead surface such as the top of the knee, and will thus give a tone of fairly constant strength; and testing a number of normal ears will show for each fork at what distance

EAR

or for how many seconds it should be heard after a standard blow. Thus if a fork which a normal ear hears at 15 inches or for 100 seconds is heard by a deaf ear only 5 inches or for 30 seconds,  $5/15$  or  $30/100$  fairly represents the fraction of hearing remaining. Ears with impairment of the percipient apparatus of the internal-ear hear high sounds relatively less as a rule; those with the more usual conduction-defect hear low tones worse. A case of "nerve-deafness" may hear no sound from the 2,000 fork—a case of tympanic catarrh none from the 50 fork; although all other tones are fairly or even perfectly heard. A whistle de-

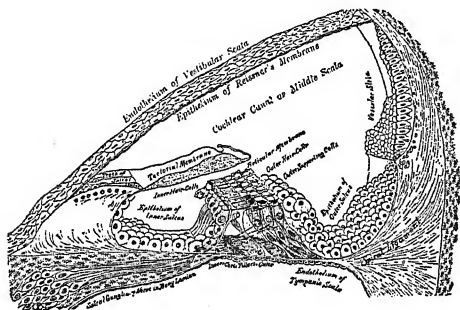


FIG. 7.—Scheme of human cochlear canal in section showing Cortis organ and its nerve connections.

vised by Galton giving tones from 4,000 up to 40,000 double vibrations is a practical and useful aid in studying the upper limits of hearing, as are the steel rods suspended by threads introduced by Koenig, since tuning-forks of such a pitch are unusual and costly. All of these tests should be made at the side of the head, but not so near that they may be *felt* instead of heard. The other ear may need to be closed with a down cushion or other adequate cover and we must avoid several "deaf-spots" nearly opposite the opening of the canal where the sound-waves by interference are weakened or lost.

Thus far we have considered tests of the hearing for sounds coming through the air in the usual way; but if the handle of a vibrating tuning-fork or other sounding instrument be rested upon the head it will be heard through the bone, and the sound will generally be much louder if the fingers are stuck into the ears. If only one ear be stopped, it will be heard louder in this ear—so much so that the other generally fails to recognize its vibration, even though the fork is resting close behind or above it. Normally this “bone-conduction” is only half as loud as “air-conduction”—the fork which should be heard for 100 seconds through the air in front of the ear is heard but 45 when resting behind it. It can usually be heard from the bridge of the nose or the teeth after it has become inaudible back of the ear; but when unheard here it should be audible for a further period if held close outside of the canal-opening. Yet disease-conditions can affect the matter like stuffing the fingers in the ears; the obstructions in the conducting apparatus which bar out in greater or less degree the outside air-vibrations shut in and echo back upon the percipient ap-

paratus sounds produced or conducted within the head. The deaf ear may hear the sound by bone-conduction better than its fellow. More than this—it can often hear better than a normal ear, perceiving through the bone for 50 seconds, perhaps, the vibrations which ought to be heard for only 45. With this generally goes a marked loss of hearing through the air, which may be reduced from 100 seconds to 40, 20, or less. Under such conditions bone-conduction will be better than air-conduction and the sound will be louder as well as longer when resting on the head. This constitutes Rinne's or Schwabach's test and is simplified by resting the handle of the lightly vibrating fork back of the ear and then placing it outside the opening with the question "louder back or front, front or back?" The perception through the bone, especially at the bridge of the nose, ought to be nearly the same in duration as the *feeling* of the vibrations by the examiner's fingers; and Gardiner Brown saved time and confusion by noting how many seconds before or after his fingers lost the vibration, it ceased to be heard in the ear. Bone-conduction may greatly preponderate, in evidence of the conductive defect in an ear with marked loss of air-conduction, and yet this test or Schwabach's timing will show that the perceptive apparatus is also defective and loses the sound sooner than normal, instead of having it exaggerated. So we must test the actual, as well as the relative, perception through the bone.

Another delicate and important test may be here mentioned. The drum-cavity communicates with the throat back of the nose by a trumpet-shaped tube called after its describer Eustachius. This serves as a drain for the removal of any mucus from the drum-cavity and as a ventilating passage for maintaining equal air-pressure on each side of the drumhead. It is really a slit habitually closed, but opens in the act of swallowing or yawning, from the action of the muscles lifting the palate. If a sounding tuning-fork, then, is held before the

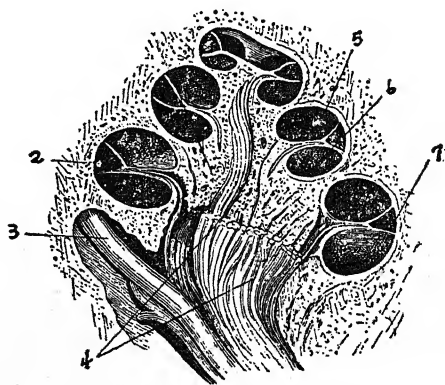


FIG. 8.—Cut through the cochlea, showing its nerve (4) passing to the turns (2,7) of the cochlear canal, above which are those of the vestibular scala. (5) and below the tympanic (6); the facial nerve. (3) is seen in close relation to the auditory.

nostrils as the patient swallows there should be a brief opening of these tubes permitting freer passage of the sound to the ear. We thus determine the normal action or its lack.

in these very essential parts of the apparatus.

This proper ventilation of the drum-cavity is needful for perfect function. It is said that the head of the military drum will split if there is no opening in the side; and certainly a stuffed Eustachian tube makes all concussions painful if not damaging to the drum-membrane. Any excess of pressure within interferes with the freedom of the windows, while any lack of air makes pressure on the outside preponderant, forcing in the drumhead and through the chain of bones pressing upon the labyrinth. More than this, if the partial vacuum in the drum-cavity is increased through absorption of the unrenewed air by the moist lining, the drumhead becomes stretched until it collapses into contact with the inner wall, or the walls congest and swell to fill the space or else fluid is poured out to occupy the cavity. Generally all of these results are present in varying degree and from this comes the large majority of ear-diseases. So, too, interference with the freedom of the breathing through the nose unfavorably affects the ears. If one holds the nose and blows, air will be forced up the tubes into the drum-cavities, and swallowing motions have to be made

his patient that only the recent losses can probably be recovered, and that ill-health or recurrent cold-takings may offset his best efforts. Yet many of these cases tend to grow steadily worse unless judiciously treated and a gain, however slight, is better than a loss. Mere inflation of air up the Eustachian tube by the Politzer bag or the catheter can aid the earlier stages; but in chronic conditions intratympanic medication must be used to stimulate the lining of the drum-cavity and retrace the steps by which it has become thickened and stiffened.

Accompanying the defect of hearing for outside sounds there may be greatly increased hearing of noises within the head. Every one hears a singing in the ear when a shell or other resonator is held against it, and similar results often follow any thickening and stiffening of the conducting apparatus. Tinnitus, as the subjective sound is called, may be due to many causes, however, and its relief is often difficult. Generally a perception of the sounds of the blood-circulation, it may be caused by changes in the blood itself in anæmia, by overaction of the heart, by brain-pressure due occasionally to stuffiness of the upper nasal passages, as well as to more local affections. It is usually worse when lying down and in a silent place, since outside noises and occupations of mind and body make it less noticeable; but it is in some cases unceasing and intrusive, seeming to bar out other hearing, and may be almost maddening. In its milder forms it is annoying and excites apprehension of deafness or of brain-disease, with which it is known to be sometimes associated; but its many causes, often wholly trivial, must be remembered and rational measures employed for its relief. As stuffing of the Eustachian tubes or tension of the drumhead and chain of bones are its common causes, much relief can often be gained by simple hot gargling to

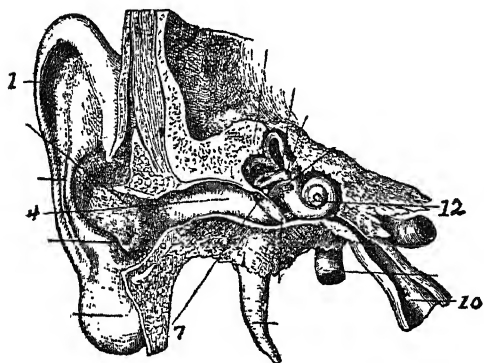


FIG. 9.—Section through external ear with its pinna (1) and (4) canal and the middle ear with its drumhead (7) and Eustachian tube (10), showing the labyrinth with its cochlea (12) and semicircular canals.

to relieve the distention. If this swallowing is done while the nose is held closed, strong suction is exercised, making partial vacuum in the drum-cavity, and this occurs when cold-taking stuffs up the nose or tonsillar enlargement narrows the upper throat just behind it. It is not surprising then, to find that two thirds of ear-patients have middle-ear trouble, only one fourth external-ear affections and in hardly one tenth is the perceptive nervous apparatus at fault. This explains why much of the treatment of ear-diseases must be directed to or through the nose and throat in the effort to restore free ventilation and repair the injury due to the lack of it. The unfavorable influences are often slow and insidious in action; deafness may be advanced in one ear without attracting the notice which any defect of the second ear quickly forces upon the attention; and treatment must be long-continued if it is to retrace much of the course by which the affection has passed to its later stages. Discouragements are frequent, and the conscientious aurist has to tell

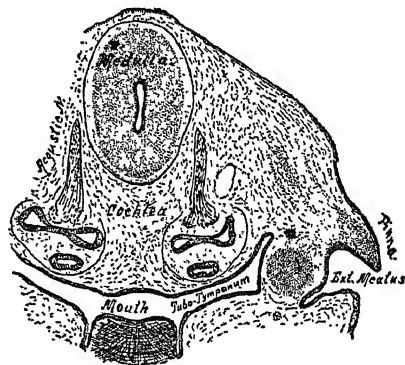


FIG. 10.—Developing ear with cartilage in the partition between external and middle ear, which are beginning to form.

free the former, or gentle massage of the drum-structures, as may be well done with the hands.

A curious characteristic of conduction-defects is the ability to *hear better in a noise*, often better than normal ears. A person deaf to ordinary speech in a quiet place will hear on a train much that is inaudible to persons nearer the speaker. One with nerve-deafness will be un-

duly disturbed by other noises, although perhaps unconscious of defect in a still place.

Only less important than freedom of the Eustachian tube is a healthy free condition of the external canal. This is lined with skin and supplied with glands like the sweat-glands elsewhere, but furnishing the ear-wax or cerumen which consists of the dead skin-scales and oily material. The purpose of this seems to be to arrest by its stickiness the entrance of dust, small insects, etc., from outside; but it serves a more useful purpose in cleansing the ear. The growth of new skin is most active at the centre of the drumhead and is there rapid enough to spread out over the membrane, moving the older cells before it by a glacier-progress which carries them beyond the margin and out upon the

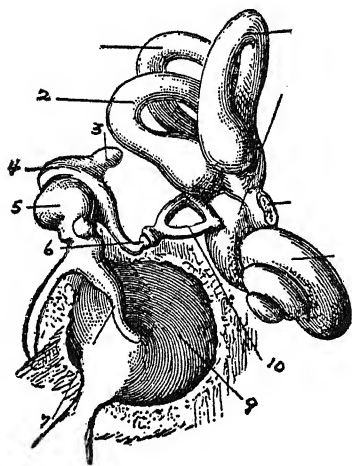


FIG. 11.—Inner surface of drumhead (9), to which is attached the handle (7) of the hammer, the head (5) of which is hinged to the anvil (4), the long arm (6) of which connects with the stirrup (10) the chain pivots on the horizontal arm (3) of the anvil and conveys vibrations to the labyrinth.

walls of the canal before they become effete enough to be thrown off. Hence the normal drumhead is self-cleansing and needs no officious aid. The loosening scales of dead skin pass out along the walls of the canal and about its middle become a pasty mixture with the secretion of the cerumen-glands. This clings to the fine hairs of the canal, but is gradually worked outward by the motions of the jaw-joint, which presses upon the canal, and drying into unnoticed scales it escapes from the exit. Under diseased conditions, including those of the throat and middle-ear, the wax tends to diminish in quantity and grow harder, escaping less readily or collecting in firm plugs. So long as any crack remains for the sound-waves to pass between it and the wall, hearing may be unaffected by an almost total filling of the canal; but jarring may force it down upon the drumhead and moisture may swell it into complete closure. Marked and sudden deafness results, often with dizziness, tinnitus or coughing. The plug may dry or crack away from the wall, quickly relieving the trouble, but only for the time; and it becomes so

moulded to the irregular curves of the canal as to make it difficult to remove. Most of the sponges and spoons offered in the drug-stores are good only for ramming in the wax more firmly and pressing it down upon the drumhead. They should never be used. The best solvent for ear-wax is hot water, and it should be syringed in with gentle force until the last particle of the plug has been removed. Dropping in of oil or other fluids rarely does much to loosen the collection, they can often increase the distress caused by its presence—they certainly cannot remove it, although some hope that they will do so seems present to many that use them. Any violence in digging out the plug or too vigorously working even with the syringe is to be condemned. Underneath it skin-flakes have been forming which are often partly incorporated in its mass, partly still fast to the walls—ready like “hang-nails” to tear down into the quick and leave open wounds, very easy of infection. One seventh of the work of the aural surgeon consists in removing ear-wax, rather especially for those of his private patients who seek to be too clean. It is easy to do it skilfully and promptly, yet it is often not so removed. If spoon-like instruments be used at all they should be sharp—they will thus be more efficient, while no mistaken idea of harmlessness will make them doubly dangerous. There is many a thing besides a firearm that a man “did not know it was loaded.”

Seeds, beads and other foreign bodies are sometimes put into the ears. If they are let alone they may remain for many years without doing the least harm; but forcible removal has often done great or fatal injury. If the ear is directed downward they will often fall out, especially with a little rotary rubbing in front of the ear. The syringe will almost invariably bring them away promptly and safely. If they have been rammed in and fixed, it is really gentler to remove them by laying forward the soft parts under ether and operating in the bony canal.

Two other affections of the external ear make up much of the 25 per cent of disease involving this part—the diffused and the circumscribed inflammations of the canal. The first may be broadly called eczema—the latter furuncle or boil. Gout and many general conditions can predispose to the eczematous inflammation, which by its heat and moisture makes the ear a hot-bed for the growth of the moulds and bacteria which maintain or increase the trouble, and it may have an intensity verging into erysipelas. The milder, chronic forms are generally responsible for furuncles, for they furnish the itching which leads to scratching and the germs which punish this. “What did you scratch it with?” will generally bring confession of a hairpin or a match-stick according to the sex, and boils are more common on the right-hand side. The suffering caused by a boil may be extreme; sometimes keeping the patient walking the floor all night. They are rarely serious matters, but each tends to cause others, so they cannot be made light of. They consist of an infective inflammation of the glands of the skin lining the canal and are apt to be trivial when the superficial sebaceous glands are involved, but more severe if a deeper cerumen-gland is

## EAR

the seat. These glands extend into the subcutaneous tissue, possibly into the periosteum, so their inflammation can excite a periostitis pressing the ear out of place and perhaps strongly suggesting mastoid inflammation. Pressure or motion of the parts, as in chewing, is acutely painful; but firm pressure on the bone can be comfortably borne if all motion of the canal be avoided. Hot douching (110° F.) is usually comforting and if fully used has an excellent tonic effect; warmth and moisture often increase and renew the trouble. The infection should be fought by mercurial oxide ointment and, if bearable, a firm plug covered with it should be passed into the swollen canal where it will exercise pressure, secure a useful massage from each jaw-motion and continue throughout the day the rubbing in of the salve.

Bony outgrowths of the walls sometimes narrow or close the external canal and less often cancerous growths involve it and the external ear. The bony growths are curiously common in the ears of ancient Peruvian and Mound-builders' skulls and in modern times in Hawaii and in England. The London surgeons among their private patients see and remove more of these bony outgrowths than are reported from all the hospitals of the world. Their causes are not clear, and bathing has been suggested as influencing their formation. As seen in other than Englishmen, the great majority seem due to long-continued discharge from the ear; and this suppuration must be cured or the growth removed, lest the confinement of pus may lead to serious or fatal complications.

The suppurative inflammations of the middle-ear form the most important phase of our subject, not only because of their malign effect in producing deafness and deaf-mutism, but from their serious menace to the life. Thousands are known to die annually from ear-diseases, and the records of large numbers of post-mortem examinations show that a larger proportion usually escape recognition during life. The prevalence of influenza for ten years past has hugely increased the frequency of serious outcomes, as well as served to bring them to notice; but even before that the record was long and grim. All the eruptive fevers, especially scarlatina, measles and typhoid, are apt to bring involvement of the ears. These should, therefore, be closely watched and generally guarded in some measure by coverings, especially in children, who may never call attention to their ears and yet if they lose hearing are prone to become deaf-mutes.

It is well known that discharge from the ear is apt to lessen or cease at the onset of serious extension and that bottling up of the flow may give rise to such results; but the somewhat prevalent view that such suppuration should be "let alone and it will be outgrown" is as mistaken as is the idea that it is dangerous to bring it to an end. To "stop it up" is wholly different from stopping it by cure: and the chronic cases of slight discharge, often hardly noticeable, are those from which fatal diseases such as brain-abscess, pyæmia, and sinus-clotting are generally recruited. Few good insurance companies will have anything to do with a man having a long-standing running ear—the risk for the individual may not be very noticeable, but it is

enough in any large aggregate to consume all the profit of insuring lives.

Suppuration of the middle-ear is ushered in by pain, and the severity of this "ear-ache" is at times some measure of the seriousness of the attack. The onset may be insidious or misleading, however, and relief may be sought of the dentist; while in children the fever, delirium or convulsions may draw attention away from the ears. Stains upon the pillow or visible moisture in the canal may be the first indications that the ears are involved. But every such case, however stormy or mild its beginning, may go on immediately or remotely to the worst of issues; and it is our duty to take reasonable precautions from the start, lest we have reason later to reproach ourselves. Mere external protection as by ear-tabs or a night-cap may conserve the recuperative powers; gentle hot douching with clean water may relieve the pain by reducing the inflammatory congestion; and spray and gargling may strike at the root of the trouble in nose and throat. However ill the patient may be in other respects it is mistaken kindness to withhold these simple yet often effective measures of treatment. The tendency is to a "gathering in the ear," which may be watery or mucous or may be purulent and infective. If the simple measures named, with dry heat from a salt-bag or hot water-bottle fail, there is need for surgical aid. Drainage by the natural Eustachian channel can only sometimes be gained; but after good cleansing of the nose and upper throat, it should be gently attempted by the Politzer method or the catheter. Abuse of these means is rightly condemned; so only the expert can maintain his right to use them if ill results follow—in spite rather than because of them. If they fail and the drumhead is seen to be bulging, especially with yellowish fluid, it should be delicately cut along its back margin to furnish a free escape for the collected fluid. If the swelling is marked at its upper portion, the knife should be carried up into this region, coming out in a sweep to the bone along the upper back wall. Free bleeding may be encouraged by warm douching, and is more effective from such a cut than from external leeching; yet since much of the blood-exit from the drum-cavity is along the front wall of the canal, leeching in front of the ear may be almost as good, but should remove not less than four to eight ounces. A wick of gauze or absorbent cotton, dry or moistened with carbolic or boric glycerine, should be inserted deep into the canal and the protective covering replaced. "But if you cut the drumhead you destroy the hearing!" is a fallacy which is still repeated. The opening of the drumhead is a delicate operation, often very painful so as to require ether or other anæsthesia and capable of doing injury to the structures beyond it; but it only forestalls the opening which would occur spontaneously, makes a free and well-placed opening and really saves the drumhead from ulcerating through. Far more important is its influence for good in relieving the injurious pressure in the drum-cavity and it may be really life-saving in preventing fatal extension of the suppuration.

It is impossible to foresee how mild or serious any case is going to prove; and without panicky fighting of shadows, it is only reasonable to

press home all due precautions. The patient is best in bed, especially if feverish, and all exposure and stimulating diet avoided. Constipation must be relieved, for straining of every sort is not only painful but increases the congestion.

With the opening, artificial or spontaneous, of the drum-membrane, there is generally relief of the pain; yet this is almost sure to recur, especially at night, but with lessening severity, duration and frequency. The fever, which is commonly marked in children, declines and some of the lost sleep is made up. The tension within the drum-cavity is lessened by the escape of the "gathering" and obtains continued relief by the persistence of the discharge. This is thin and bloody at first, then thicker and probably stringy. Its amount is often surprising, so that hourly cleansing is needful, and it may excoriate the skin in and about the canal, calling for protective ointments. The ideal treatment is thoroughly to cleanse before cutting the drumhead and thereafter as frequently as the flow demands to change the sterile wicks of cotton in the canal. If these are prepared by the hundred, each wrapped in a waxed paper and the package of them baked, the patient can readily remove the moist plug and substitute a clean one without contaminating it. Practically, frequent syringing with boiled water at 110° F. or more and a clean soft-rubber bulb better relieves the pain and cleanses the deeper parts of the canal. The heat can penetrate where the water cannot and is the best astringent and stimulant. After two or three weeks the discharge should cease, and another week or two should bring cure; but the cardinal fact in these cases is the infected character of the inflammation, which endangers serious destruction in the drum-cavity and adjacent more vital regions. Often worse than the destruction is the scarring which results from nature's effort at repair. An opening in the drumhead generally heals and may leave no visible scar; in an important minority of cases the edges are skinned over, preventing its closure and grafting skin upon the mucous surfaces within. Nature is prepared to sweep away fluid waste material in the drum-cavity, but skin-flakes forming there are difficult of removal; they tend to collect and by their presence excite more exaggerated scaling. Onion-like masses may thus form, constituting "cholesteatoma" or pearly tumor, and these can do much damage by their pressure as well as maintain or renew the suppuration. The bony walls and the little ear-bones may be destroyed by pressure or decay; and while an exit may thus be made for the cholesteatoma-mass, it too often works inward instead of outward, damaging the labyrinth and may carry the infective process into the brain-case. Just under the thin floor of the drum-cavity is the head of the jugular vein, its intracranial part is equally vulnerable just behind, and an even thinner roof alone protects the brain-membranes above. It is not surprising, then, that symptoms of brain-inflammation are not unusual in ear-diseases; and while these may be merely irritative and transitory, they are at times of deadly meaning. Where the bone suppurates and decays the mastoid-projection just behind the ear is apt to be involved, forming a "mastoid abscess," and may need to be chiseled open to

give exit to the matter and dead bone. Even without this, the inner wall of bone can decay and an abscess-collection form on the outer surface of the brain-membrane. Yet this is strong and firm and may thicken to better protect all within; so such "extra-dural abscesses" have but a fraction of the danger of a collection upon or in the brain itself. Even this can now be often recognized in time by its subnormal pulse and temperature, and located sufficiently by its symptoms to permit of surgical relief; and nearly 80 per cent of the reported operations have been followed by cure. The infection can penetrate the adjacent great blood-vessels and cause clotting within them, with general blood-poisoning and formation of abscesses in the lungs or other parts of the body; but the septic clot can be recognized and safely removed in many cases even when extending down almost to the heart.

Disease of the nervous apparatus of the internal ear is met in hardly 10 per cent of ear-patients. Some of these are due to injury and fracture at the base of the skull, others to cerebro-spinal meningitis or other severe fevers, more still to the extension inward of the catarrhal or the suppurative middle-ear inflammations. Mumps, too, or diphtheria may be followed by sudden total deafness. Inherited syphilis is one of the insidious and slowly acting causes, generally also giving rise to clouding of the cornea of the eye and marked by typical malformation of the second teeth. In any of these conditions the main hope of relief is through the absorption by mercury and iodine of the exuded material, which in the meningitis cases may be in the brain itself and not in the labyrinth. Of notable interest are the cases of "boiler-makers' deafness," as we sometimes call a group of occupation-disorders, usually located in the internal ear, and affecting those subject to persistent clangor—a condition which may compel change of work, if freeing the Eustachian tubes and good plugging of the external canals fails to relieve the advance of deafness. Important too are the cases of vertigo, due to ear-disease. Menière called attention to some of these as caused by labyrinthine apoplexy and they are often called by his name; but the recognizable disease may be of different nature and often is located in the drum-cavity, indirectly affecting the organ of equilibrium in the semicircular canals. Influenza has caused a number of these cases in which the hearing for more or less of the scale has been suddenly lost and the patient made incapable for days or weeks of lifting the head from the pillow. Absorption is here also the best hope; but in some extreme cases advantage has been taken of the damaging effect upon the ear of large doses of quinia, and the irritative condition has been by it changed to a destruction with cessation of the vertigo.

Finally we may mention the brain-affections in which the hearing-centres, especially that for speech, are involved, when we may have "word-deafness," which prevents recognition of the spoken word, although the hearing is perfect for tones of every pitch; for while the ear itself is uninvolved, it is only through ear-examination that one can by exclusion reach a correct diag-



nosis and perhaps point the way for the surgical removal of a brain-tumor. 6

**Bibliography.**—H. Helmholtz, 'Die Lehre von den Tonempfindungen' (1863); J. Hyrtl, 'Vergleich anat. Untersuchungen über das innere Gehörorgan des Menschen und der Wirbelthiere' (1845); J. Leidy, 'The Anatomy of the Temporal Bone' (1878); G. Retzius, 'Das Gehörorgan der Wirbelthiere' (1884); G. Schwalbe, 'Lehrbuch der Anatomie der Sinnesorgane' (1887); Randall and Morse, 'Photographic Illustrations of the Anatomy of the Ear' (1887); H. Schwartz, 'Lehrbuch der Ohrenheilkunde' (1892); A. Politzer, 'Textbook of Diseases of the Ear' (1902); G. Bacon, 'Manual of Otology' (1902); M. Hovel, 'Treatise on Diseases of the Ear' (1898); De Schweinitz and Randall, 'American Text-book of Diseases of the Eye, Ear, Nose, and Throat' (1899).

B. ALEX. RANDALL, M.A., M.D.

**Ear Cockle**, a disease peculiar to wheat caused by the presence in the grain of worms belonging to the family *Vibria*. In some parts of Europe the disease is known as purples.

**Ear-ring**, a ring or other ornament for the ear, a hook passing through the lobe, with a pendant of diamonds, pearls, or other jewels, frequently attached. It seems to be in repute among all nations, the most savage as well as the most civilized, and it dates from the most remote antiquity. In Gen. xxiv. 22 we read that Abraham's servant presented Rebekah with an ear-ring, and the same ornament is mentioned in several other passages of Scripture. In the statue of Aphrodite by Praxiteles the goddess was represented with rings in her ears. Among the fine specimens of antique art now extant there are several heads bearing only a single ear-ring on the left ear; and it appears that the Greek children only wore them on the right ear. Ear-rings were not so commonly worn by men as by women, yet, that men did sometimes do so is evident from the fact that the Emperor Alexander Severus thought it necessary to interdict this ornament to men. The ear-rings worn by the ancients sometimes consisted of simple rings, but pendants were frequently attached to them, and these sometimes very heavy. The form of the pendants was various. The Roman ladies used ear-rings of great value. European women, as well as some of the men, wear ear-rings at the present day, although the custom has become almost obsolete in the United States and children's ears are no longer pierced as formerly.

**Ear-shell**, **Sea-ear**, **Oreille de Mer**, names for European species of *Haliotis*. See **ABALONE**.

**Ear-trumpet**, an instrument used by persons partially deaf to strengthen the sensation of sound. The purpose of the external ear, both in men and beasts, is to collect, by its funnel form, the waves of sound, and conduct them to the internal organs, the seat of the sense of hearing. All the artificial instruments, then, ought to resemble in form the natural ear. They are sometimes made like a trumpet of moderate size, the smaller aperture enters the ear, and the wider is directed to the quarter from which the sound proceeds. But these instruments are inconvenient, both on account of their size and the necessity of continually holding to the ear. Ear-

cornets (so called from the French, *cornet acoustique*) are applied to the outside of the ear, and kept in their place by a slender steel spring. A small instrument in the form of a scroll, called an auricle is worn inside the ear, the mouth only being visible. Flexible india-rubber tubes, kept open by a spiral wire spring, are among the most convenient forms of ear-trumpet.

**Ear-worm**. See **CORN INSECT-PESTS**.

**Ear of Dionysius**, a famous cavern near Neapolis, in which the slightest whisper was audible at a great distance. It was connected by a secret passage to the palace of Dionysius, the Elder, of Syracuse, who died 367 B.C., also an acoustic instrument with a large mouthpiece to collect the sound, which a flexible tube conducts to the ear of the person.

**Eard'ley-wil'mot**, **Sydney Marrow**, English rear admiral: b. East Sheen, Surrey, 3 Oct. 1847. He entered the navy in 1861, retiring in 1893. He has published 'Life of Vice Admiral Lord Lyons'; 'Our Navy for a Thousand Years'; 'Our Fleet To-day and its Development during the Last Half Century'; 'Our Flags: Their Origin, Use and Traditions.'

**Earl**, **Robert**, American jurist: b. Herkimer, N. Y., 10 Sept. 1824; d. there 2 Dec. 1902. He was graduated from Union College 1845, and was admitted to the bar 1848. Elected county judge in 1855 he served two terms and in 1869 was elected to the court of appeals, retiring in 1894. He founded the Herkimer Free Library in his native town.

**Earl**, a degree of the British nobility between marquis and viscount. The title was made hereditary by William the Conqueror, and for a time was used interchangeably with that of count, the corresponding title on the Continent. The wife of an earl is still called a countess. An earl's coronet is composed of eight pearls raised upon points, with small leaves between, above the rim. Though not of the highest rank earl is the title of highest antiquity in Great Britain. See **HERALDRY**.

**Earl Marshal**, the eighth great officer of state in Great Britain, who had, anciently, several courts under his jurisdiction, as the court of chivalry and the court of honor. He is the head of the College of Arms (Herald's College), grants armorial bearings, and determines all claims in connection with them. The office is hereditary in the family of the Howards.

**Earle**, **eri**, **Alice Morse**, American writer: b. Worcester, Mass., 27 April 1853. She was married to Henry Earle in 1874. She has written extensively upon the manners and customs of the colonial period in New England and New York. Her published works are: 'The Sabbath in Puritan New England' (1891); 'Customs and Fashions in Old New England' (1893); 'Life of Margaret Winthrop' (1894); 'Diary of a Boston School Girl' (1894); 'Costumes of Colonial Times' (1895); 'Colonial Dames and Goodwives' (1895); 'Old Narragansett' (1896); 'Curious Punishments of Bygone Days' (1897); 'Colonial Days in Old New York' (1897); 'Home Life in Colonial Days' (1898); 'Child Life in Colonial Days' (1899); 'Stage Coach and Tavern Days' (1900); 'Old Time

Gardens; Sundials and Roses of Yesterday' (1903).

**Earle, Ferdinand Pinney**, American soldier: b. Hartford, Conn., 11 Sept. 1839; d. 2 Jan. 1903. He served as a private soldier in the Federal army during the Civil War. In 1889 he was appointed on the staff of Gov. Hill of New York to represent the artillery branch of the State service with the rank of brigadier-general. In 1884 he was decorated by the Venezuelan government with the Order of the Bust of the Liberator as a recognition of services rendered that country.

**Earle, John**, English ecclesiastic: b. York, England, 1601; d. Oxford 17 Nov. 1665. He was educated at Oxford and after graduation became tutor to Prince Charles and accompanied him in his exile. After the Restoration he was advanced in succession to the offices of dean of Westminster, bishop of Worcester, and bishop of Salisbury. He was the author of several works, the best known being 'Microcosmographie,' one of the "character" books popular in the 17th century.

**Earle, John**, English philologist: b. Elston, England, 29 Jan. 1824. He was educated at the Plymouth New Grammar School and at Kingsbridge Grammar School in early life, entering Oxford in 1842. He took his B. A. degree in 1845 and was elected fellow of Oriel. Taking the degree of M. A. in 1849, he became professor of Anglo-Saxon, being later ordained deacon. He was presented by Oriel to the rectory of Swanswick 1857; appointed to the prebend of Wanstrow 1871, and became professor of Anglo-Saxon in the University of Oxford 1876. His chief publications are 'Gloucester Fragments' (1861); 'A Book for the Beginner in Anglo-Saxon' (1877); 'English Plant Names from the Tenth to the Fifteenth Century' (1880); 'Anglo-Saxon Literature' (1884); 'English Prose: its Elements, History and Usage' (1890); 'The Psalter of 1539: a Landmark in English Literature' (1894); 'A Simple Grammar of English Now in Use' (1897).

**Earle, Mary Tracy**, American fiction writer: b. near Cobden, Ill., 21 Oct. 1864. She was educated at the University of Illinois and since 1893 has devoted herself to literary pursuits. She is the author of 'Through Old-Rose Glasses and Other Stories' (1900); 'The Man Who Worked for Collister'; 'The Wonderful Wheel'; 'The Flag on the Hill Top' (1902).

**Earle, Mortimer Lamson**, American classical scholar: b. New York 14 Oct. 1864. He was educated at Columbia College, receiving his A. B. degree in 1886. He was instructor in Greek at Barnard College for six years beginning 1889, and was then appointed associate professor of Greek and Latin in Bryn Mawr College; 1898 to 1900 was lecturer in Greek at Columbia; and in 1900 was appointed professor of classical philology in Barnard College. Among other literary work he has edited Euripides' 'Alcestis' (1895), and Sophocles' 'Edipus Tyrannus' (1900).

**Earle, Parker**, American horticulturist: b. Mount Holly, Vt., 8 Aug. 1831. He took up his residence for some years in Illinois and became a trustee of the State University; thence he removed to Mississippi. At the

World's Exposition at New Orleans, in 1884, he superintended the horticultural department, and since 1885 has been president of the American Horticultural Society.

**Earle, Pliny**, American inventor: b. Leicester, Mass., 17 Dec. 1762; d. there 19 Nov. 1832. In 1785 he became engaged in the manufacture by hand of machine and hand cards for carding cotton and wool, and invented in 1790 a machine for the manufacture of such cards by which the labor of one man for 15 hours could be performed in as few minutes.

**Earle, Pliny**, son of the preceding, American physician: b. Leicester, Mass., 31 Dec. 1800; d. Northampton, Mass., 18 May 1892. He was educated at the Friends' School, Providence, R. I., and was graduated as M.D. at the University of Pennsylvania in 1837. He was resident physician of the Asylum for the Insane at Frankford, near Philadelphia, 1840-2; physician to Bloomingdale Asylum N. Y., 1844-9; elected professor of materia medica and psychology in the Berkshire Medical Institution at Pittsfield, Mass., in 1863, and was superintendent of the Massachusetts State Hospital for the Insane 1864-1885. In the years 1837-39, 1849 and 1871, he traveled in Europe visiting the most important insane asylums. He is the author of 'Marathon and other Poems' (1841); 'Institutions for the Insane in Prussia, Germany, and Austria' (1853); 'An Examination of the Practice of Blood-letting in Mental Disorders' (1854).

**Earlham College**, a coeducational institution in Richmond, Ind., founded in 1847, under the auspices of the Order of Friends. In 1902 the school had in attendance 300 students and 21 instructors.

**Early, Jubal Anderson**, American soldier: b. Franklin County, Va., 3 Nov. 1816; d. Lynchburg, Va., 2 March 1894. He was graduated from the United States military Academy in 1837, fought in the Seminole war (1837-8), and having resigned from the service, entered legal practice at Rocky Mount, Franklin County, Va., in 1838. A member of the Virginia House of Delegates in 1841-2, he was also attorney to the commonwealth in 1842-7 and 1848-52. During the Mexican War he was major (1847-8) of volunteers; and at the outbreak of the Civil War, although strongly opposed to secession, he received the appointment of colonel in the Confederate forces. Promoted brigadier-general for services as a brigade commander in the first Bull Run, he fought with distinction at Williamsburg, the second Bull Run, and Antietam. He was in command of a Confederate division at Gettysburg, and in 1864 of an army for the invasion of Maryland. He crossed the Potomac, defeated Lew Wallace at Monocacy Junction (9 July), threatened an attack on Washington, D. C., but at the arrival of a considerable Union reinforcement, withdrew to the Shenandoah, possession of which he contested with Sheridan, then commanding the Federal army in the valley. On 19 September he was defeated at Opequon Creek, with the loss of 3,000 prisoners and 5 guns, and on 22 September at

## EARLY ENGLISH ARCHITECTURE—EARTH

Fisher's Hill, where he lost heavily, and from which point he was driven to the mountains. On 19 October he surprised the Federals in the morning at Cedar Creek, but the tide of victory was turned by Sheridan's arrival from Winchester, and he was completely routed. After his defeat by Custer at Waynesborough (March 1865), he was removed from his command. He attained lieutenant-general's rank. Subsequent to the war he practised law in Virginia, and was, with General Beauregard, a director of the Louisiana lottery. He never took the oath of allegiance. He is ranked high in the list of Confederate officers, and by some authorities was considered not inferior to "Stonewall Jackson." His chief publication is a 'Memoir of the Last Year of the War for Independence in the Confederate States of America' (1867). Consult 'Battles and Leaders of the Civil War,' edited by Johnson and Buell (1887).

**Early English Architecture**, the name generally given to the first pointed Gothic used in England. This style of architecture began to be used in England about the end of the 12th century, and lasted for about 100 years. It immediately succeeded the Norman, and finally merged in the Decorated style. It is characterized by long lance-shaped windows, which are often gathered into clusters and enclosed by a large arch, the space between which and the tops of the windows is often pierced with circular, trefoil or quatrefoil ornaments. The molding consist of alternate rounds and deeply cut hollows, separated by small fillets. The doorways are often divided into two by a single shaft.

**Earth, The.** The earth is at once the subject and the object of many sciences. Of these the most elementary are geography and physiography, which deal primarily with the salient surface features of our planet. Next in order of difficulty are geodesy and geology, which deal more minutely with the shape, the size, the constitution, the mechanical properties, and the material history of the earth. The science of meteorology is concerned with the phenomena of the atmosphere; and our theories of the tides and terrestrial magnetism must be added to the list of purely physical sciences of the globe. All of these sciences are intimately related, and they are sometimes grouped under the single term geophysics. In a broad sense, also, these sciences may be regarded as branches of astronomy, for astronomy is founded on, and hence includes, geophysics. This article is written from the point of view of geophysics and deals especially with the physical and mechanical properties of the earth.

### THE SHAPE AND THE SIZE OF THE EARTH.

**First Approximation.**—The form and the dimensions of the earth have presented a problem of the greatest interest and difficulty to men of science for more than twenty centuries, and they promise to tax the resources of the ablest physicists for some centuries to come. The first approximation to a solution of this problem, of which we have definite record, was made by Eratosthenes of the Alexandrian school of astronomers. Assuming the surface of the earth to be spherical, he measured the length and the angular amplitude of an arc of a great circle

extending from Alexandria to Syene. He observed that at Syene, which is about 500 miles south of Alexandria, the sun shone vertically downwards into deep wells at noon on the day of the summer solstice, proving thus that at that place and time the sun was in the zenith. On the same day at Alexandria he observed, by means of the gnomon, that the sun at noon was south of the zenith by one fiftieth of a circle, or  $7.2^\circ$ . The principles involved in these measurements and in the calculation of the size of the earth are very simple, but they are so fundamental as to justify a full explanation. They assume, first, that the earth is spherical in shape; secondly, that the plumb bob at any

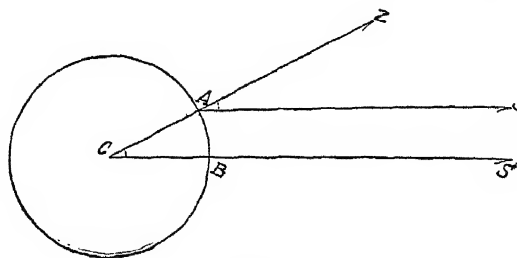


FIG. 1.

point of the earth's surface is directed towards the earth's center; and, thirdly, that the sun is so distant that lines drawn to it from different parts of the earth are sensibly parallel. Thus, in Fig. 1, if A and B indicate the relative positions of Alexandria and Syene and C the center of the earth, lines from A and C to the sun will be parallel; and hence the angle ZAS, or the meridian zenith distance of the sun at Alexandria, will be equal to the angle ACB. Knowing this angle and the distance AB, the rule of three gives the entire circumference.

**Second Approximation.**—No substantial advance beyond this first approximation was made until Newton showed that the gravitation and the rotation of the earth ought to make it somewhat flattened at the poles, or that the surface of the earth should have the shape of an oblate spheroid of revolution. The proof of this theoretical conclusion of Newton constitutes the second approximation to the figure and the size of the earth. Such a figure, however, is much more difficult of measurement than a spherical

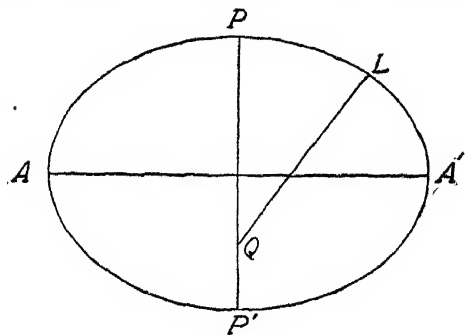
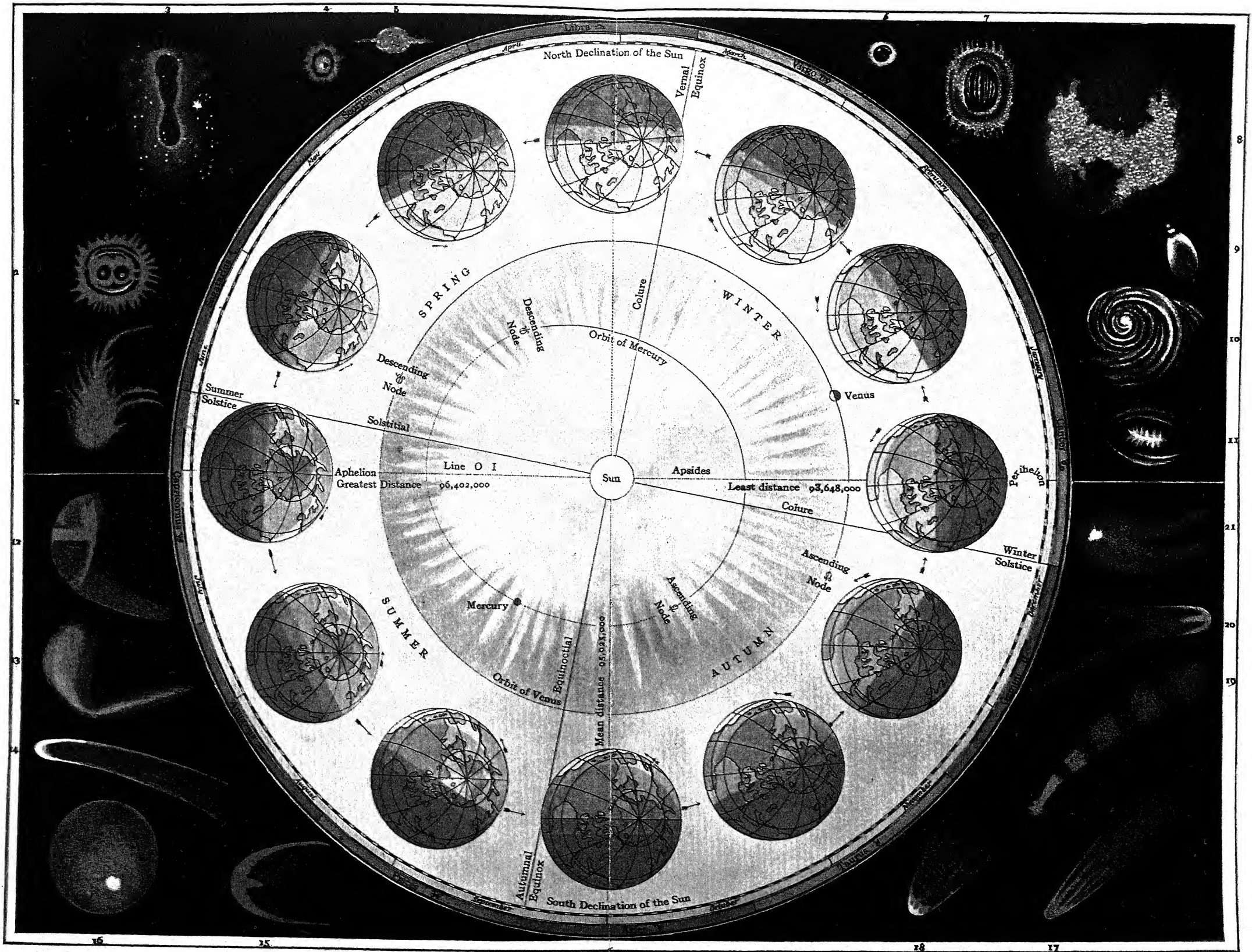


FIG. 2.

figure. This is seen by a glance at Fig. 2, representing an ellipse, which, if revolved about its shorter axis  $PP'$ , will generate an oblate spheroidal surface. The principles of mechanics



# THE EARTH—ITS ANNUAL REVOLUTIONS AND THE SEASONS OF THE YEAR



NEBULÆ. 1. The Crab Nebula. 2. Round Nebula. 3. Great Nebula in Argo. 4, 5, 6, 7. Nebulæ as shown by Lord Rosse's Telescope. 8. The Dumb-bell Nebula. 10. The Spiral Nebula. 9, 11. Nebulæ as shown by Lord Rosse's Telescope.

COMETS. 12, 13, 14. Halley's Comet as seen in 1835 at different periods. 15. Halley's Comet as departing from the sun, 1836. 16. Encke's Comet as seen in 1828. 17. Great Comet of 1811. 18. As seen departing from the sun. 19. Comet of 1680. 20. Comet of 1807 as seen by Bessel. 21. As seen by Schroeber.





## EARTH

show that when such a surface is due to the attraction and the rotation of a fluid mass, the plumb line at any place will not in general point towards the centre of the mass, but will pass somewhat to one side of it, as shown by the line LQ in the figure.

Newton's conception, therefore, involved the difficulties of the more complex spheroidal figure and of the hypothesis that the earth was primitively a fluid mass. Two ways of testing Newton's views were proposed. One was to measure the meridional lengths of a degree of latitude at different places on the earth's surface. If the earth is an oblate spheroid, it is seen from Fig. 3 that the meridional distance along the surface intercepted by two plumb lines which make an angle of one degree (or any constant angle) with each other is greater at the poles than at the equator, or in general, greater in high than in low latitudes. The other method proposed to measure by means of the pendulum the varying acceleration to which a body is subject in different latitudes on the earth's surface. If the Newtonian view is correct, that acceleration, which is the resultant of the effects of attraction and rotation of the earth, and hence the weight of a body, must increase in passing from the equator to the poles.

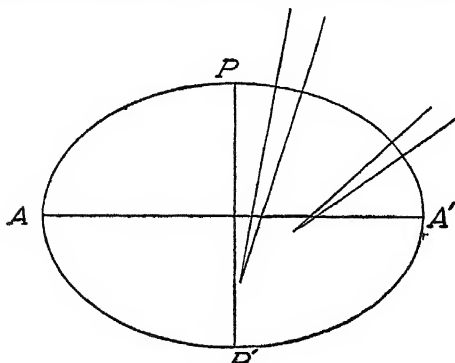


FIG. 3.

But the Newtonian theory was neither readily accepted nor easily verified. In the early part of the 18th century, in fact, the theory was hotly opposed by the justly distinguished Cassinian school of French astronomers, whose erroneous interpretation of a carefully measured arc of a meridian in France indicated that the earth is an oblong rather than an oblate spheroid. The question was permanently settled by the famous Lapland expedition sent out by the Academy of Sciences of Paris, in 1735, under the auspices of Maupertuis and Clairaut. They proved beyond doubt that the earth's surface is very closely that of an oblate spheroid, thus "flattening the poles and the Cassinis," as Voltaire remarked at the time.

A vast amount of labor has since been devoted to the determination of the dimensions of the spheroid which best fits the earth's surface. This is, indeed, the principal problem of the precise geodesy of to-day. The dimensions of the earth which have been provisionally very generally adopted are those of General A. R. Clarke published in 1866. The theory of a spheroidal surface requires a knowledge of the lengths of the longer and the shorter axes of

the generating ellipse, or equivalent data. Generally the half axes, or the equatorial and the polar radii are given. The values of these are as follows:

Equatorial semi axis =  $a$ , polar semi axis =  $b$ .  
 $a = 20,926,062$  feet = 3,963.3 miles = 6,378,259 meters.  
 $b = 20,855,121$  feet = 3,949.8 miles = 6,356,635 meters.

It should not be inferred from these figures that the semi axes are known to the nearest foot or meter. The values given above are those derived from computations carried out to the nearest foot. More approximate values will be determined from computations now in progress, and they may possibly show Clarke's values to be in error by a few hundred feet.

The following derived values appertaining to the earth's spheroid are often referred to:

Equatorial diameter of the earth..... = 7,926.6 miles  
 Polar diameter of the earth..... = 7,899.6 miles  
 Difference of diameters..... = 27.0 miles  
 Circumference of equator of earth..... = 24,902.0 miles  
 Meridian perimeter of earth..... = 24,859.8 miles

Area of the surface of the earth  $\left\{ \begin{array}{l} = 196,940,000 \text{ square miles} \\ = 510,071,000 \text{ square kilometers} \\ = 197 \times 10^9 \text{ square miles (about)} \\ = 51 \times 10^7 \text{ square kilometers (about)} \end{array} \right.$

Volume of earth  $\left\{ \begin{array}{l} = 259,880,000,000 \text{ cubic miles} \\ = 1,083,200,000,000 \text{ cubic kilometers} \\ = 260 \times 10^9 \text{ cubic miles (about)} \\ = 108 \times 10^{10} \text{ cubic kilometers (about)} \end{array} \right.$

The following table gives the length of a degree of a meridian in different latitudes; the length of a degree in longitude measured along a parallel of latitude; and the areas of quadrilaterals of the earth's surface of one degree extent in latitude and in longitude. The latitude in the first column of the table is that of the middle point of the corresponding meridional arc or quadrilateral.

Latitude	Length of 1° of meridian	Length of 1° of parallel	Area of quadrilateral 1° × 1° in latitude and longitude
	Statute miles	Statute miles	Square miles
0°	68.703	69.171	4752.3
10	68.725	68.128	4682.0
20	68.786	65.026	4472.8
30	68.879	59.956	4129.6
40	68.993	53.063	3661.0
50	69.115	44.553	3079.2
60	69.230	34.674	2400.5
70	69.324	23.729	1645.0
80	69.386	12.051	836.2
90	69.407	00.000	

From the second column of this table it is seen that the length of a degree of a meridian is about seven tenths of a mile greater at the poles of the earth than at the equator.

*Third Approximation.*—A third approximation to the figure of the earth may be briefly referred to here. Imagine the mean sea level, or the surface of the sea freed from the undulations due to winds and to tides. This mean sea surface, which may be conceived to extend through the continents, is called the geoid. It does not coincide exactly with the earth's spheroid, but is a slightly wavy surface lying partly above and partly below the spheroidal surface, by small but as yet not definitely known

## EARTH

amounts. The determination of the geoid is now one of the most important problems of geophysics. Its solution will be accomplished by means of gravimetric surveys, or by measuring the acceleration of gravity at a great number of points on the earth's surface.

### PHYSICAL PROPERTIES OF THE EARTH.

*The Atmosphere.*—Adopting the convenient terminology of geologists, the earth may be divided into four parts, namely: the atmosphere; the hydrosphere, or oceans; the lithosphere, or crust; and the centrosphere, or nucleus. These are considered in turn without encroaching on the fields of the meteorologist or of the geologist.

The atmosphere is a gaseous envelope covering the earth to an extent not yet fully determined. The pressure it exerts at the surface of the earth is easily measured and is definitely known to be about 14.7 pounds per square inch, or about 1,033 grammes per square centimeter.

The pressure, density, and temperature of the atmosphere are observed to decrease rapidly with increase of height above the earth's surface, but the exact laws of decrease are not yet known. Hence it is impossible in the present state of science to assign a height to the atmosphere. It appears certain, however, that it is more than two hundred miles high, since it is dense enough to set meteorites on fire at that height.

Many investigations of the properties of the atmosphere have been made during the past century. These are all too technical for presentation, even in abstract, here. But their results may be summarized as follows:

(a) If the earth did not rotate and if the atmosphere were of the same density throughout as at the earth's surface, its height would be 26,200 feet, or about 5 miles.

(b) If the earth did not rotate, and if the adiabatic law (pressure proportional to the 1.4 power of the density) held in the atmosphere, it would be about 17 miles high.

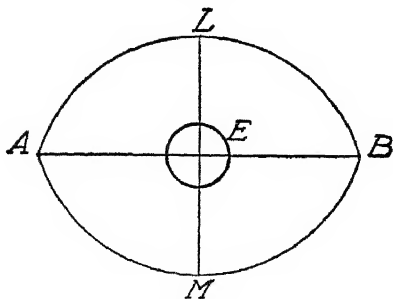


FIG. 4.

(c) But the earth rotates and the atmosphere must be supposed to rotate with the same angular velocity. From this fact, and from the assumption that the atmosphere behaves like a fluid, Laplace concluded that it must be limited by a lenticular-shaped envelope as indicated in Fig. 4. The revolution of this figure about the axis LM, which is supposed to be coincident with the axis of rotation of the earth, E, will generate the envelope and the earth in their true relative dimensions. The polar and equatorial axes LM and AB are, re-

spectively, 4.4 and 6.6 times the diameter of the earth. According to this theory, therefore, the atmosphere may be about 17,000 miles high above the poles of the earth and about 26,000 miles high above the equator. The latter limiting height is that at which the centrifugal force due to rotation is just balanced by the attraction of the earth. The volume of the envelope is 156 times the volume of the earth. Whether the atmosphere actually extends to the limits thus defined has not been determined either by Laplace or by subsequent investigators.

A question of great interest is that of the quantity of the atmosphere, since the oxygen thereof is essential to the existence of all higher forms of life on our planet. By quantity is meant the amount of mass of the atmosphere. If the law of distribution of this mass within the Laplacian envelope were known the total quantity could be computed. But that law is not known, and hence it is only possible to attain an approximation, or to set limits, to the actual amount. A lower limit may be found from the adiabatic distribution of (b), above, for a non-rotating earth. This distribution does not differ widely from the actual distribution near the earth's surface; but since it is limited to a height of 17 miles it will give too small an amount. A computation on this basis makes the mass of the atmosphere 1-1700000th part of the total mass of the earth; or, in round numbers, one millionth part of the mass of the earth. This result is also reached, substantially, if it is assumed that the mass of the atmosphere is the same as the mass of a uniform layer of water, or mercury, which would produce the same pressure at the earth's surface. On the other hand, if the adiabatic distribution is supposed to hold within the Laplacian envelope, of (c), above, an upper limit of about 1-1200th of the mass of the earth is obtained. The actual value of the mass of the atmosphere is undoubtedly much closer to the lower than to the upper limit; but how much closer is still a matter for investigation.

*The Hydrosphere.*—It is well known that about three fourths of the earth's surface is covered by oceans and seas. Precise measures of the relative areas of land and sea are difficult to obtain, and the present state of knowledge does not justify the use of more than three significant figures in defining these areas. The values given below are derived from H. Wagner's 'Lehrbuch der Geographie.' They do not differ widely from the values given recently by other German authorities, though they make the total ocean area about one per cent greater than the earlier estimates of the distinguished British geographer, Sir John Murray. The table below gives the continental areas along with their average heights and the total oceanic area along with its average depth:

CONTINENT	Area in square miles	Average height or depth, in feet
Europe .....	3,860,000	980
Asia .....	17,100,000	3,120
Africa .....	11,500,000	2,130
North America .....	9,260,000	2,300
South America .....	6,840,000	1,970
Australia .....	3,440,000	1,310
Total continental area...	52,000,000	2,300
Total oceanic area.....	145,000,000	11,480

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The total area of the continents is, therefore, 26.3 per cent of the total surface of the earth; leaving, with the same degree of precision, for the total area of the sea surface 73.7 per cent of the surface of the earth.

The average depth of the oceans according to Wagner is 3,500 meters or 11,480 feet, or, in round numbers, 2.2 miles.

The data thus given show that the volume of the oceans is 315,000,000 cubic miles, or, in round numbers, 1-800th of the entire volume of the earth. Assuming the density of sea water to be 1.03 times that of pure water, and the density of the latter to be 62.3 pounds per cubic foot, the mass in the oceans is found to be  $1.49 \times 10^{18}$  tons of 2,000 pounds, or one and one half million million million tons.

It is interesting to contrast this mass of the oceans with the mass of the continents which lies above sea level. The average heights of the continents given in the above table require an average height for the entire land area of about 2,300 feet. This combined with the area of the continents gives for the volume of the continents above sea-level 22,500,000 cubic miles. If to this mass a density of 2.75 times that of water be attributed, the resulting mass of the continents above sea-level is  $284 \times 10^{15}$  tons. This is about one fifth the mass of the hydrosphere, or oceans.

*The Lithosphere.*—The lithosphere is the special province of the geologist, and is treated in detail under GEOLOGY. It is here considered, therefore, only in its broader physical aspects.

No precise value to the thickness of the shell which is called the crust can be assigned. The estimates of geologists make it 5 to 10 miles thick. It is the shell to which are confined the great rock movements and transformations with the attendant phenomena of crust crumpling, folding and faulting. For the present purposes it may be assumed to be 10 miles thick.

In its mechanical aspects the most important fact presented by the crust is that it rests on the centrosphere, or nucleus, in substantially the same manner as a fluid crust would. In other words, the crust is essentially, in view of the forces to which it is subject, a viscous mass, which may be likened in its behavior to sealing wax. This conclusion is reached when one compares the compression to which the crust would be subjected if it were self supporting, like a dome, with the crushing strength of rocks. That compression is about thirty times the crushing strength of the finest steel and five hundred to one thousand times that of the best building stones. Hence we must infer that at a depth of a few miles there can be no such thing as a cavity in the crust. Another conclusion of great importance, also, is that the surface shape of the earth must conform very closely to the shape it would have if it had been originally fluid, as assumed by nearly all geodesists and geologists, many of whom adduce that shape as a proof of primitive fluidity. Given time enough, and the amount of time available is ample, as seen below, the viscous earth will assume the same shape, essentially, as a fluid earth.

Since the lithosphere, the hydrosphere, and the atmosphere are the theatre of the principal activities, physical and biological, of our planet, it is of interest to know their volume, mass, and chemical constitution. The volume of the shell

10 miles thick below sea level is 1,969,400,000 cubic miles. Adding to this the volume of the crust above sea level, namely, 22,500,000 cubic miles, there results for the volume of crust and hydrosphere down to a depth of 10 miles below sea level, 1,992,000,000 cubic miles. Of this, as stated above, 315,000,000 cubic miles are sea water, leaving for the solid matter of the crust to the depth in question 1,677,000,000 cubic miles. Attributing to this volume a density 2.75 times that of water, the mass of this solid part of the shell is  $21 \times 10^{18}$  tons of 2,000 pounds. This is about 14 times the mass of the oceans. These two masses and that of the atmosphere give, in round numbers, a total of  $23 \times 10^{18}$  tons, the contribution from the atmosphere being taken as  $7 \times 10^{16}$  tons.

CHEMICAL COMPOSITION OF THE LITHOSPHERE, HYDROSPHERE, AND ATMOSPHERE.

ELEMENT	Solid crust	Oceans	Mean, including atmosphere
Oxygen .....	47.29	85.79	49.98
Silicon .....	27.21	...	25.30
Aluminum .....	7.81	...	7.26
Iron .....	5.46	...	5.08
Calcium .....	3.77	0.05	3.51
Magnesium .....	2.68	0.14	2.50
Sodium .....	2.36	1.14	2.28
Potassium .....	2.40	0.04	2.23
Hydrogen .....	0.21	10.67	0.94
Titanium .....	0.33	...	0.30
Carbon .....	0.22	0.002	0.21
Chlorine .....	0.01	2.07	0.15
Bromine .....	...	0.008	...
Phosphorus .....	0.10	...	0.09
Manganese .....	0.08	...	0.07
Sulphur .....	0.03+	0.09	0.04+
Barium .....	0.03	...	0.03
Nitrogen .....	...	...	0.02
Chromium .....	0.01	...	0.01
	100.00	100.00	100.00

Professor F. W. Clarke, making use of the above data, has worked out the relative abundance of the chemical elements in the combined mass of the atmosphere, the hydrosphere and the lithosphere. His results are given in the preceding table. (See Bulletin of the United States Geological Survey, No. 78.) It is interesting to note that nearly one half of that part of the mass of the earth visible to us is oxygen, the next most abundant contributions being in order, silicon, aluminum, iron and calcium.

*The Centrosphere.*—Since the crust of the earth, as seen above, rests like a viscous fluid on the centrosphere, the latter, whatever its temperature and other properties, must be subject to great internal stress. Indeed, the mechanics of celestial bodies of large mass leads inevitably to the conclusion that pressure is the dominant factor in the earth at no great depth below the surface. Given time enough, therefore, the distribution of pressure will be essentially the same as if the mass of the earth were fluid. This justifies the application of the laws of hydrostatics to the earth as a whole, whether it was originally fluid or not. With this concept, and with the law of gravitation, several facts enable us to determine within narrow limits what must be the constitution of the earth as regards distribution of density, gravity and pressure. The principal of these facts are (1) the surface

## EARTH

density, (2) the mean density, and (3) the surface value of the acceleration of gravity. In addition to these facts, there are some others of less importance depending on the attraction of external bodies on the earth. Laplace correlated all these facts by means of an hypothesis with regard to the compressibility of matter. This asserts that the pressure in the earth increases as the square of the increase in density.

Adopting the indications of Laplace the following table showing the variation of density, acceleration of gravity, and pressure with depth below the surface of the earth has been computed. The relatively unimportant effect of the rotation of the earth is ignored in the calculation. The assumed values of the surface density and the mean density are 2.75 and 5.5, respectively, times that of water. In the third column of the table  $g$  represents the average surface value of the acceleration.

DISTRIBUTION OF DENSITY, ACCELERATION, AND PRESSURE IN THE EARTH.

Depth in fractions of earth's radius	Density relative to water	Acceleration of gravity	Pressure in millions of pounds per square inch
0.0	2.75	1.00g	
0.1	3.9	1.04	3.09
0.2	5.0	1.04	7.24
0.3	6.2	1.00	12.42
0.4	7.2	0.94	18.37
0.5	8.2	0.84	24.53
0.6	9.1	0.72	30.61
0.7	9.8	0.55	35.99
0.8	10.3	0.38	40.30
0.9	10.7	0.20	43.04
1.0	10.8	0.00	43.96

It is seen from this table that the acceleration attains a maximum value. This value is 1.05 times the surface value and it is attained at a depth of about 610 miles. At this depth a given mass would have a greater weight than at any other distance from the earth's center. A more extended table, computed by the author from slightly different data, is given in the article on GEOLOGY.

The variation of the density, acceleration and pressure are shown graphically in the following diagram, Fig. 5, in which these quantities are all measured horizontally from the line AO, representing the earth's radius, to the right. The curves have different horizontal scales and are designated, respectively, D.C. (density curve), A.C. (acceleration curve), and P.C. (pressure curve). The pressure curve intersects the axis OQ at right angles at Q.

Another interesting question in this connection is what total radial compressibility is compatible with this Laplacian distribution of density, acceleration and pressure. The answer may be stated in convenient form thus: If the pressure of the atmosphere were to be doubled the radius of the earth would be shortened everywhere by about 2 meters, or 6.5 feet. This explains how mere inequalities in surface loading of the earth may account for some of the great observed movements of the earth's crust.

**Acceleration at Surface of Earth.**—What is commonly called the acceleration of gravity at the surface of the earth is the resultant of the accelerations due to the attraction and to the

rotation of the earth. This quantity has been measured with considerable precision at various points of the earth's surface by means of the pendulum, and the results have been combined in the following formula,  $g$  being the accelera-

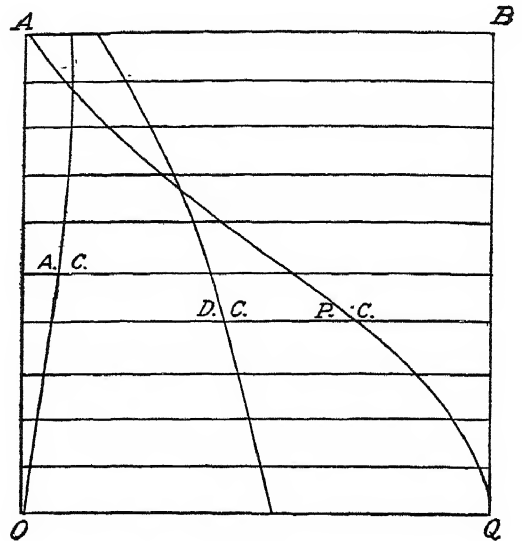


FIG. 5.

tion at any point of the sea level whose latitude is  $\phi$ :

$$g = 978.00 + 5.22 \sin^2 \text{ centimeters / (seconds)}^2 \\ = 32.087 + 0.171 \sin^2 \text{ feet / (second)}^2.$$

**Mean Density and Mass of the Earth.**—Since the volume of the earth is known accurately, the mass can be computed if its density can be ascertained. The author has recently shown (The Astronomical Journal, No. 424), that the product of this mean density and the gravitation constant may be derived with a precision comparable to that of the value of the acceleration just given above. The gravitation constant is the quantity essential to convert the proportionality of Newton's law of gravity into an equality. That is, if  $m$  and  $m'$  are two masses,  $D$  their distance asunder,  $F$  the force of attraction they exert on one another, and  $k$  the gravitation constant, then

$$F = k \frac{mm'}{D^2}.$$

It is thus seen that  $k$  is not a mere number, but a quantity such that the second member of the equation is force as well as the first member.  $k$  is, in fact, the cube of a length divided by the product of a mass and the square of a time.

Denoting the mean density of the earth by  $\rho$ , it is found in the paper referred to that

$$k\rho = 36797 \times 10^{-11} / (\text{second})^2.$$

this quantity being the reciprocal of the square of a time. In a more interesting, as well as a more intelligible, form this relation may be written

$$k\rho = \frac{3\pi}{T^2}$$

where  $\pi$  is the number 3.1415+ and  $T$  is the time it would take an infinitesimal satellite to pass around the earth, under the law of gravi-

## EARTH

tation, just grazing the equator, if there were no atmosphere to impede its progress. This time is seen to be 1 hour, 24 minutes, 20.9 seconds.

It is clear then that  $\rho$  will be given by the above equation if  $k$  is known. This quantity has been measured directly by several observers. A mean of the most recent and most trustworthy determinations is, in C.G.S. units. (See 'The Century's Progress in Applied Mathematics,' Science, N. S., Vol. XI.)

$$k = 6673 \times 10^{-11}.$$

Thus  $\rho$  is found to be 5.514 times the density of pure water. The uncertainty of this value as shown by the computation is about four units in the last place of decimals. In view of this fact, and of the great difficulties in measuring the quantity  $k$ , we shall use the round number 5.5 as hitherto.

From the volume of the earth given above the following results are derived for its mass:

$$\begin{aligned} \text{Mass of Earth} \quad \left\{ \begin{array}{l} = 1,311 \times 10^{24} \text{ pounds} \\ = 6,352 \times 10^{18} \text{ tons (of 2,000 pounds)} \\ = 5,945 \times 10^{20} \text{ kilogrammes} \end{array} \right. \end{aligned}$$

For convenience of reference the masses that have been given above are here collected and expressed in tons of 2000 pounds.

Mass of Earth	= $6,550 \times 10^{18}$
Mass of Centrosphere	= $6,529 \times 10^{18}$
Mass of Lithosphere	= $21 \times 10^{18}$
Mass of Hydrosphere	= $1.49 \times 10^{18}$
Mass of Atmosphere	= $7 \times 10^{15}$

*The Internal Heat of the Earth.*—That the earth has a great store of heat a few miles below the surface is amply proved by a variety of geological phenomena. Wherever deep wells, or bore holes, have been sunk the temperature is observed to increase with depth at a rate of about a degree F. for 60 feet. This shows that heat is being conducted from the interior to the surface of the earth and is thence radiated into surrounding space. The amount of this heat is sufficient to melt a layer of ice 6 to 8 millimeters (or  $\frac{1}{4}$  inch, say) thick, covering the globe, per annum, or more than 800 cubic miles of ice. It seems most probable (though it is by no means certain) that the temperature of the centrosphere is high enough to melt all known rocks, although the lower strata of the crust do not assume the molten or viscid form of lavas except on relief from the great pressure to which they are subject. This was, essentially, the view of Fourier, the earliest physicist to investigate this question, and it is still regarded as the most plausible hypothesis with respect to the actual state of the earth.

Whether this hypothesis is exact or not, however, the theory of heat conduction founded by Fourier enables us to draw with certainty two important conclusions with respect to the earth, namely: (a) that the heat conducted from the interior to the surface escapes as if there were neither atmosphere nor oceans; and (b), that a million years is the smallest unit of time convenient for measuring the historical succession of thermal events.

With less certainty it may be affirmed that the earth is shrinking in bulk as it cools, and that this is one of the principal causes of the grand crust crumpings and volcanic activities to which geologists pay special attention. This cubical contraction goes on exceedingly slowly, however; requiring, so far as one can infer from

present indications, nothing short of thousands of millions of years for its completion.

*The Earth as a Time Keeper.*—The time of rotation of the earth is the most trustworthy unit of time man has discovered. The present value of this unit is 86164.1 mean solar seconds. That the earth must rotate with great steadiness is at once apparent when the immense amount of its energy of rotation is considered. This energy is about  $156 \times 10^{27}$  foot-pounds, or  $2 \times 10^{30}$  ergs. It is more than will be developed at Niagara (at the present rate of 5 million horse-power, say) in a million million years. Nevertheless, the period of rotation of the earth is subject to variation from four obvious causes. These are (1), secular contraction of the earth's mass; (2), the influx of meteorites, or meteoric dust; (3), tidal friction; and, (4), shiftings in position of the surface load of the earth, as in the processes of sedimentation, glaciation, etc.

The effects of the first two causes have been investigated. ('The Astronomical Journal,' No. 502.) Contraction tends to shorten the day, and may possibly cause a diminution of as much as six per cent of the present length. The change goes on very slowly, however, and will not be perceptible in any such interval as that of human history (20 centuries, say). Meteoric dust tends to lengthen the day; but at the present rate of influx (about 20 millions of meteorites daily) the effect will not amount to so much as a quarter of a second in less than a million million years. During this interval of time the total effect, substantially, from secular contraction will have accrued.

The effects of the other causes named have not been evaluated, though the last one is probably the most important of all of them; since it may be easily shown that such shiftings of the surface load as are now taking place on the earth may modify the length of the day by an amount which, if cumulative, might in a few centuries seriously disturb astronomical reckonings.

*Bibliography.*—Laplace, 'Mécanique Céleste' and 'Système du Monde'; Todhunter, 'History of the Theories of Attraction and the Figure of the Earth' (1873); Clarke, 'Geodesy' (1880); Helmert, 'Die Mathematischen und Physikalischen Theorien der Höheren Geodäsie' (1880 vol. i.; 1884 vol. ii.); R. S. Woodward, 'Smithsonian Geographical Tables', published by the Smithsonian Institution, Washington (1894); Thomson (Lord Kelvin) and Tait, 'Treatise on Natural Philosophy' (1890).

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**Earth, Race Population of the.** The total population of the earth is estimated at 1,440,650,000, divided among the following races: Mongolian, 650,000,000; Indo-Germanic, 545,500,000; negro, 150,000,000; Semitic, 65,000,000; Malay, 35,000,000; Indian, 15,000,000; Hottentot, 150,000. The human family is subject to 45 principal governments. The average duration of human life is estimated at 33 years. The deaths are calculated at 67 per minute, 97,970 per day, and 35,639,835 per year; the births at 70 per minute, 100,800 per day, and 36,792,000 per year. One quarter of the people of the earth die before age 6, one half before age 16, and only one in 100 attains to the age of 65.

## EARTH CURRENTS—EARTH, INTERNAL HEAT OF

**Earth Currents**, a term used in electricity. Telegraph lines and particularly long submarine lines, are constantly troubled by violent electrical disturbances of the nature of transient currents which rush in one direction or the other through the line. The name earth currents is given to these movements of electricity. They are frequently so powerful and so changeable as to render the use of the telegraphic instruments for the time impossible, the earth currents passing so rapidly as to confuse the speaking signals completely. The nature of these disturbances is not thoroughly understood. They are found, however, to be very intimately connected with the perturbations of terrestrial magnetism called magnetic storms, and these, it is well known, are closely connected both with the appearance of the *aurora borealis*, and with the occurrence of the sun's spots. It seems probable that earth currents and the aurora are due to secondary discharges taking place in consequence of alterations in terrestrial magnetism, and that these alterations in terrestrial magnetism are caused by violent solar disturbances.

**Earth-houses**, a name generally given throughout Scotland to underground buildings, also known as "Picts' houses" or "Picts' dwellings." The earth-house in its simplest form consists of a single irregular-shaped chamber, formed of unhewn stones, the side walls gradually converging toward the top until they can be roofed by stones of four or five feet in width, all covered in by a mound of earth rising slightly above the level of the surrounding district. In the more advanced form of these structures two or three chambers are found. Earth-houses are frequent in the northeast of Scotland, occasionally 30 or 40 being found in the same locality. Very similar structures, known as bee-hive-houses, occur in Ireland. In the United States modern earth-houses are to be found in Nebraska, Kansas and other western States, and are commonly called "dug-outs." In Arizona and California certain dwellings of adobe may be designated as earth-houses. See ADOBE.

**Earth-shine** is the light reflected from the sunlit surface of the earth on the obscured portion of the moon's surface, for a few days before and after new moon, rendering it faintly luminous with a dark grayish light, and giving it the appearance popularly known as "the old moon in the new moon's arms." The phenomenon is stronger before than after new moon. See MOON.

**Earth, Internal Heat of.** There is abundant evidence that the interior of the earth is warmer than the surface. All deep mines, tunnels, and borings show a temperature considerably in excess of that which prevails in the shallower strata. At Rosebridge Colliery, near Wigan, England, a temperature of 94° F. was found at the depth of 2,445 feet, although the mean temperature of the surface is only about 49°. We have thus an increase of 45°, which is at the rate of about 1° for every 54 feet of depth. In the Mont Cenis tunnel, at one part where there is a thickness of a mile of rock overhead, the temperature was 85°. The tempera-

ture at the depth of 400 metres in the well of Grenelle at Paris is 75°, the temperature of the superficial strata being about 52°. In a bore through rock-salt at Sperenberg, near Berlin, the temperature at the depth of 3,490 feet was found to be 116°, the mean temperature of the air at the surface being only about 48°. At Yakutsk, in Siberia, where the mean temperature of the air is 13½°, it was found, in sinking a well to the depth of 540 feet, that the soil (which was frozen for the entire depth) increased in temperature by about 1° for every 52 feet of descent.

There is usually a considerable amount of irregularity in the rate of increase at different depths. In a deep boring at Wheeling, W. Va., the increase in the 1,000 feet from 2,375 feet to 3,375 feet is about 13°, while the increase in the next 1,000 feet is more than 16°, the temperature at that depth being 108°. Also, the mean rate of increase is by no means the same at all places, being sometimes as rapid as a degree for every 40 feet, and sometimes as slow as a degree for every 80 feet. Its average value appears to be about a degree (F.) for 50 or 55 feet.

The simplest theory to account for the increase of temperature in descending is that which supposes that the earth has formerly been at a high temperature throughout and is gradually cooling. This theory has been fully developed by Lord Kelvin. Solid rock has greater specific gravity than melted rock, even at the same temperature. Hence, if the earth were originally melted, and were then subjected to loss of heat from its surface, the solid crust which would form would from time to time fall in and allow fresh portions of liquid to come to the surface, until a solid interior had thus been formed, containing perhaps numerous cavities filled with liquid, but having on the whole the characteristics of a solid globe. After this stage a few hundred years would suffice to make the surface nearly as cool as it is at present, although a temperature nearly as high as the melting-point of rock would still exist at the depth of a few feet. The cooling would gradually penetrate deeper, and the rate of increase of temperature with depth would become slower, until, after about 100,000,000 years, this rate would be reduced to the value which it has at present. If we suppose the earth not to have been originally melted, but to have had a temperature considerably below the melting-point, a still shorter period of time would suffice to bring about the present condition of things. Hence Lord Kelvin argued that the age of the earth, as a globe cool enough for habitation cannot be greater than about 100,000,000 years. Professor Tait, on revising the physical data on which this calculation was based, came to the conclusion that the limit must be drawn still closer, namely, at about 10,000,000 years.

It was, until quite recently, maintained by geologists that the solid part of the earth consisted only of a thin crust enclosing a molten interior. This has been disproved by Lord Kelvin, both by the line of argument above sketched, and also by another argument based on the phenomena of the tides. A thin crust enclosing a liquid or pastry interior would yield and change its shape under the action of those forces (emanating from the moon and sun) which produce the tides. Evidently if the sur-



## EARTHENWARE—EARTHQUAKE

face and bottom of the sea at a given place rise together and fall together, the depth of water may remain unaltered. The observed effect is the difference between the tide at the surface and the tide at the bottom. Hence the observed effect will be greater with a rigid than with a yielding earth. Now the observed effect agrees with what calculation gives on the supposition that the earth taken as a whole is highly rigid, and is completely at variance with calculation on the supposition that the earth is highly flexible.

Volcanic eruptions have an obvious connection with the question of the condition of the earth's interior. According to one theory they are due to local generation of heat by friction. The outermost layers of the earth have long since attained a nearly permanent temperature. The layers below them are cooling more rapidly, and have therefore a tendency to shrink faster. This tendency finds its relief from time to time in dislocations, which are the source of earthquakes, and which frequently involve the rubbing of one part against another under the enormous pressure of the superincumbent weight. Such friction would certainly involve an enormous local development of heat. See EARTHQUAKE; VOLCANO.

**Earthenware**, vessels or objects of clay, as distinguished from porcelain, is opaque, as distinguished from stoneware the body is dull and earthy. The clay is baked or fired in a kiln, or more rarely sun-dried. The glaze depends on the quality of the ware; generally it is of a readily fusible character and contains lead; but a simple salt glaze is employed for common articles. Occasionally the unglazed body is employed, as for water-bottles, cream-jugs, vases, and ornaments; these have generally a reddish-brown color, due to iron. The finer kinds of earthenware, such as Majolica, Delft ware, Faience, and Palissy ware, are not only glazed, but are besides elaborately colored and enamelled and ornamented with raised figures of various kinds. See FAIENCE; POTTERY.

**Earthnut**, a common name for many unrelated plants. The most common are probably the following: *Bunium flexuosum*, and *B. bulbocastanum*, both members of the natural order *Umbellifera*, the latter referred by some botanists to the genus *Carum* (caraway). Certain species of *Carum*, *Enanthe*, and *Cherophyllum* of the same natural order, also bear this common name. All these species are natives of Europe and all bear tubers which have been used to some extent for human food, but are more valued as food for swine, since the animals can be turned loose to root them out of the ground. They are also known as earth chestnuts, pig-nuts, etc. Certain species of *Cyperus* of the order *Cyperaceæ* are also called earthnut (see NUT-GRASS), and so are various species of the natural order *Leguminosæ*, especially *Arachis hypogæa* (see PEANUT), *Apois apios*, or *tuberosa* (see GROUND-NUT), known also as wild bean.

**Earthquake**, a trembling of the earth's crust due to internal causes. It consists of a series of undulatory impulses or elastic waves, transmitted through the rocks of the crust in somewhat the same way that sound is transmitted through the air. These waves are of two classes: (1) compression waves propagated

parallel to the direction of transmission; (2) distortion waves normal to the direction of transmission. The speed with which these waves are transmitted varies greatly. It is greatest near the starting point and diminishes somewhat as the waves die out. The speed is also affected by differences in the elasticity and homogeneity of rock masses. In general it varies from several hundred to several thousand feet per second. The waves of the Charleston earthquake, 31 Aug. 1886 (the data were carefully compiled), had the great speed of nearly 16,000 feet per second. The destructive effects of earthquakes are due to the high velocity of the undulatory impulses rather than to the amplitude of the vibrations since the latter is usually only a very small fraction of an inch and but rarely is as much as two inches.

The violence of earthquakes varies greatly. Delicate instruments, seismographs, constructed to show variations in the stability of the earth's crust, show that the crust is almost continually trembling even in regions where shocks of some magnitude are rarely felt. Earthquakes are sometimes classified as central and linear: in the first the undulatory impulses radiate from a centre of origin or focus in all directions; in the second the strong impulses are felt along narrow strips of the earth's crust. If rocks were of equal elasticity and an earthquake focus were a point, the undulatory impulses would travel outwardly in all directions and at the surface of the earth points equally distant from the focus or seismic centre, would feel the shock at the same moment and the isoseisms or lines drawn through places simultaneously affected would form circles. The point over the seismic centre when the shock is vertical is termed the epicentrum. The results from the study of earthquake data are often variable and puzzling and the determination of the focus is not an easy matter. In general the seismic centre has been found to be not a point but an area and in the case of the Agram earthquake in Hungary (1880), the area must have been large since vertical impulses were felt over a considerable region. It is also known that the seismic centre is very seldom 30 miles below the surface and the commonest depth is 8 or 10 miles. The seismic centre of the Charleston earthquake was at a depth of about 12 miles.

An earthquake tremor may be felt on the surface distinctly and not in the lower levels of a deep mine and *vice versa*. The size of the area when the trembling is perceptible probably bears some proportion to the violence of the initial shock. The great Lisbon earthquake (1775) was distinctly felt from Madeira to Great Britain or over the whole of southwest Europe and northwest Africa. The Charleston earthquake was felt from northern Florida to New England and as far west as Iowa, or over an area approximately 1,000 miles long and 800 miles wide. In the Lisbon earthquake the tremors lasted but about six minutes. In the Calabrian earthquakes (1783-7) the trembling was practically continuous for four years. When an earthquake occurs beneath the sea, the ocean above is uplifted and the shock spreads outwardly in low long waves that travel rapidly but are slower than the earth waves. In mid-ocean such waves are of no importance, but as they approach shore the drag of the sea bottom decreases their speed and length, but greatly increases their height, and

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what are erroneously termed tidal waves result. On a low-lying coast such waves may be very destructive. The explosion of Krakatoa in August 1883 caused sea waves that went around the world at a speed of 400 miles an hour. At distant points like the coast of Europe, the waves were slight, and were detected by tide gauges. On the coast of Java the waves were over 60 feet high and thousands of people were drowned. An earthquake in the North Pacific in June 1896 caused waves 40 feet high along the northern coast of Japan, that did great damage, over 27,000 people being drowned. Such an earthquake wave on the coast of Peru once picked up a gunboat of the United States navy and left it stranded a mile inland. Earthquakes are usually commonest in regions of present or recent volcanic activity. In the United States they are commonest in California, and in general earthquakes are more often felt near the coasts than inland, just as volcanoes are more often found near the sea. At the same time there is a seismic zone encircling the whole earth in which earthquakes are more numerous than elsewhere, and this zone does not coincide with the distribution of volcanoes. The zone includes Central America, the West Indies, the Azores, Italy, Syria, Persia, Afghanistan, Tibet, Japan, and Hawaii. It is by some regarded as the real earthquake centre, since shocks in regions without the belt are sometimes traced to disturbances within it. Thus the earthquakes of the Mississippi valley (1812) ceased when the volcano of St. Vincent, 2,000 miles distant, burst into activity. The sounds that accompany earthquakes have been variously compared to the rumbling of thunder, the clanking of chains, etc.; sometimes loud sounds accompany slight shocks.

*Causes of Earthquakes.*—As earthquakes are frequently connected with the eruptions of volcanoes, and are common in volcanic regions, many observers have thought that earthquakes were volcanic phenomena. This view was first expressed nearly 2,000 years ago by Pliny, and during the first half of the 19th century was held by many geologists including von Humboldt. From the fact, however, that many earthquakes in the countries about the Mediterranean, in California, and elsewhere, are not accompanied by any volcanic activity, and since any heavy shock or blow within the earth's crust would be propagated by undulatory impulses to the surface, causing an earthquake, it is now generally recognized that earthquakes are due to a variety of causes. It is plain that some earthquakes are due to the explosions of steam that are the chief characteristics of violent volcanic eruptions. Thus the terrific explosion that tore off the greater part of the island of Krakatoa (1883) was the cause of a violent earthquake. Earthquakes frequently precede volcanic outbursts and cease as the eruption begins. Again it is possible that in regions of present or recent volcanic activity when no volcanic outbreak accompanies or follows an earthquake the latter may have been caused by movements of molten rock deep underground. The sudden expansion of such rock, if pressure were relieved by the opening of some fissure, as in the formation of dikes, might cause a severe earthquake. In regions remote from volcanoes it is probable that earthquakes are caused by the same stresses in the earth's crust,

partly due to secular contraction, that tilt and fold rock strata into mountains. The strains to which the rocks are thus subjected when suddenly relieved by the rocks giving way produce many earthquakes. In fact, the slight earthquakes of frequent occurrence in the Alps, Himalayas, and in southern Oregon, indicate that mountain building is still in progress. The seismic zone that encircles the earth is, therefore, simply a zone of weakness in the earth's crust, within which crustal movements are frequent. Earthquakes in regions remote from any volcano have usually, when carefully studied, been traced to some line of rock weakness as a fault. Such earthquakes are merely phenomena accompanying rock movements that may in time greatly modify the earth's surface. The frightful loss of life caused by some violent earthquakes has led to their geological importance being exaggerated. Many earthquakes in Japan are believed to be caused by accumulations of submarine sediments sliding down the steep slope of the continental shelf just east of Japan.

*Effects of Earthquakes.*—Aside from the destruction of life and property the work done by most earthquakes is relatively unimportant. Of geological effects may be mentioned landslides in mountainous regions, as in the earthquakes in 1870 in northwestern Greece. Such landslides may divert the course of streams. Violent earthquakes are frequently accompanied by the opening of fissures in the ground, which may or may not close again. Several were formed in the Charleston earthquake, while the Mississippi valley earthquake resulted, apparently, in depressions of the surface over considerable areas. As noted before, earthquakes frequently accompany the formation of faults. Thus the Owen's Valley, Cal., earthquake (1872), accompanied the formation of faults along the base of the Sierra Nevada, the maximum throw being 20 feet. In the Lisbon earthquake that killed 60,000 people, the quay sank into the sea, with all the people near it. In the Calabrian earthquake (1783), which killed 32,000 people, more than 200 lakes and small swamps were formed. Lyell says an earthquake at the mouth of the Indus (1819) resulted in forming a lake covering 2,000 square miles. While downward displacements of the earth's crust are of common occurrence, elevations are much less common and some geologists deny that any elevation has ever been observed after an earthquake. See MOUNTAIN; TIDAL-WAVE; VOLCANO; EARTH; INTERNAL HEAT OF, etc.

*Bibliography.*—Dutton, 'Charleston Earthquake of 1886' (9th An. Rep. U. S. Geol. Sur.); Milne, 'Earthquakes' (1883); Reports of British Association on Earthquakes (1852-61); 'Transactions of the Seismological Society of Japan' (1880-90); Hoerne's 'Erdbebenkunde' (1893).

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**Earths**, a term applied by alchemists to substances which were considered elementary bodies, but since the researches of Lavoisier and Sir Humphry Davy, defined as metallic oxides, or compounds of oxygen with metals similar to potassium and sodium. Earths are seldom found in a state of natural purity, but constitute chiefly, the component parts of gravel, soil, and strata. The more important earths are divided into two classes; alkaline earths,

## EARTHWORKS—EASEMENT

lime, baryta, strontia, and magnesia; and proper earths, alumina, zirconia, glucina, yttria, and thorina; most of these are treated under separate titles, to which refer. The alkaline earths resemble the alkalis. They are soluble in water; baryta and strontia readily, lime sparingly, and magnesia very slightly. Their solutions affect vegetable colors similarly to the alkalis. They combine with acids, forming neutral salts, some of which are readily soluble in water, and others insoluble. The proper earths are insoluble and infusible, and by exposure to heat lose the property of easy solubility in acids.

**Earthworks**, in military parlance, are permanent or temporary defenses chiefly of earth forming a shield against the enemy's fire. For the various forms of military earthworks see FORTIFICATION; TRENCH.

**Earthworm**, annelid of the order *Oligochaeta* (q.v.). Although certain families of *Oligochaeta* are strictly aquatic and others exclusively terrestrial, still others contain both aquatic and terrestrial species, and aside from peculiarities which are obviously adaptations to the mode of life no sharp distinctions can be drawn between these two classes. The earthworms generally are larger and more robust, with shorter setæ than the waterworms, and have dorsal pores. Within recent years the earthworms have attracted much attention from systematic writers and no less than 800 species, of which upwards of 90 inhabit North America, are now known. Externally they look much alike, but in their internal anatomy exhibit an astonishing variety. The common earthworms of Europe and America, of which a dozen or more species may be found in almost any suitable locality, belong chiefly to the genera *Lumbricus* and *Allolobophora* which have the setæ arranged in four pairs on each somite, a well-developed girdle or clitellum occupying a variable number of segments toward the anterior end, the female and male genital pores on the 14th to 15th segments respectively, and various complex internal peculiarities of the reproductive organs. While our species rarely equal a foot in length, several South African and Australian species reach five feet. Earthworms inhabit nearly all parts of the earth except the frozen regions of high latitudes and altitudes, dry sandy soils, and some portions of the North American prairies. Their habits are everywhere much alike. They burrow in damp earth, which the common kinds penetrate to the depth of about two feet. They swallow the soil, and after digesting its nourishing elements reject the rest in the form of castings from the mouths of their burrows. At night they partly leave their burrows and draw to them the petioles of leaves, etc., on which they feed and with which they close the openings in cold weather. In this way they also seek one another's company and copulate, as hermaphrodites mutually fertilizing each other. A cocoon is formed by secretions of the clitellum and receives the eggs and spermatozoa in a quantity of albumen as it slips past the openings of the genital ducts toward the head, from which it passes and remains in the earth. During the winter they burrow to a depth beyond the reach of frost, but some species at least will survive actual freezing. The importance of earthworms as cultivators of the soil can scarcely be over-

estimated. By their burrowing they render it porous and permeable to the rain and air; they continually turn the earth by bringing up soil from beneath the surface, and they add to its fertility by burying vegetable matter and by their secretions. Darwin has estimated that earthworms bring to the surface in rich meadow lands not less than one fifth inch of soil per annum, and recent laboratory experiments demonstrate most emphatically the beneficial influence on plants of the presence of earthworms. Consult: Beddard, 'Monograph of the Oligochaeta,' and Darwin, 'Formation of Vegetable Mould.'

**Earwig**, an orthopterous insect, forming type of a family, *Forficulidae*, and an order *Dermaptera*. This insect has generally a habit of concealing itself in cavities, endeavoring to reach their innermost recesses, and in some rare cases may have sought a hiding place in the ear, but its passage into the internal ear would be stopped either by the waxy secretions or by the tympanic membrane. The common earwig (*F. auricularia*) is found throughout Europe, in north Africa, Asia Minor, and North America. It has a length of from two fifths to two thirds of an inch; the antennæ are thread-like, and the number of joints is 15. The fore wings are short, horny, and somewhat rectangular, but the larger hind wings are thin and mainly membranous, and fold up somewhat like a fan under the fore wings. The last segment of the abdomen carries a pair of curved, horny, pincher-like appendages, which in the male are toothed at the base. The eggs are laid in spring, about 20 at a time, and are carefully protected by the female. The young earwigs differ little except in size from the mature insects; they are guarded by the mother during the first period of their existence. Earwigs shun light as far as possible and this habit is taken advantage of by gardeners to catch them and destroy them. In the daytime they may be found in various situations, such as beneath the bark of trees, under stones, in the soil, or in any suitable hole. They feed on fruits, seeds, leaves, and flowers, and at times on animal refuse. Eight other species of this genus are found in Europe. In the genus *Chelidura*, represented in Europe by nine species, the wings are altogether wanting. *Labia* is another genus with only one European species (*L. minor*), which is common in Great Britain about manure heaps and similar habitats.

**Easement**, an incorporeal hereditament, comprising a permanent public or personal right as legal owner of one parcel of land, to use, or forbid its use, for some special purpose, with regard to a parcel of land belonging to another owner. This definition includes easements strictly so called, which are always appurtenant to land, public easements, and easements in gross or such as are attached to the person. In more general terms it is said that the right of making use of the land of others, whether it be that of the public or individuals, for a precise and definite purpose, not inconsistent with a general right of property in the owner, especially where it is for the public use, is in legal contemplation an easement or franchise, and not a grant of the soil or general property. In the civil law the land against which the privilege exists is called the servient tenement; its proprietor the servient owner; he

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in whose favor it exists, the dominant owner; his land the dominant tenement. And, as these rights are not personal and do not change with the persons who may own the respective estates, it is very common to personify the estates as themselves owning or enjoying the easements. Easements have these essential qualities. There must be two tenements owned by several proprietors: the dominant, to which the privilege is attached; the servient, upon which it is imposed. Considered strictly, easements exist only in favor of, and are imposed only on, corporeal property. They confer no right to any profits arising from the servient tenement. They are incorporeal. At common law they may be temporary; by the civil law, the cause must be perpetual. They impose no duty on the servient owner, except not to change his tenement to the prejudice or destruction of the privilege. Easements are of various kinds. They are as various as the exigencies of domestic convenience or the purposes to which buildings or land may be applied. The following attach to land as incidents or appurtenances, to wit: The right of pasture on other land; of taking game on other land; of fishing in other waters; of taking wood, minerals, or other produce of the soil from other land; of receiving air, light, or heat from or over other land; of receiving or discharging water over, or having support to buildings from other land; of going on other lands to clear a mill stream, or repair its banks, or draw water from a spring there, or to do some other act involving ownership; of carrying on an offensive trade; of burying in a church, or a particular vault, etc. Some of these are affirmative or positive, that is, authorizing the commission of acts on the lands of another actually injurious to it, as a right of way,—or negative, being only consequentially injurious, as forbidding the owner from building to the obstruction of light of the dominant tenement. Easements of every kind must originate in a grant or agreement, express or implied, of the owner of the servient tenement. By the common law, the evidence of their existence may be by proof of the agreement itself, or by prescription, requiring actual and uninterrupted enjoyment immemorially, or for upward of 20 years, to the extent of the easement claimed, from which a grant is implied. Easements of the negative kind do not admit of possession, and by the civil law they cannot be acquired by prescription, and can only be proved by grant. Use is not essential, therefore, to their existence. Easements may be extinguished by release; by merger, when the dominant and servient tenements are united under the same title and to the same person; by necessity, as by a license to the servient owner to do some act incompatible with its existence; by cessation of enjoyment, when acquired by prescription,—the non-user being evidence of a release where the abandonment has continued at least as long as the user from which the right arose. A shorter time will answer in some cases.

**East, Alfred**, English artist b. Kettering, Northamptonshire, 15 Dec. 1849. He studied in Paris at the *École des Beaux Arts* and under Julian and Bouguereau. He has exhibited at the Royal Academy for many years, and among his works are: 'A Passing Storm,' in the Luxembourg, Paris; 'A Haunt of Ancient Peace,' in

the National Gallery of Hungary; 'The Nene Valley,' in the Permanent Gallery of Venice; 'An Idyl of Spring,' in the Preston Gallery.

**East**, a cardinal point of the compass, and the quarter of the heavens in which the celestial bodies make their appearance. The exact direction may be determined by the eastern right angle of a perpendicular meridian line, which points due east. East differs in direction for each locality on the earth's surface, at the poles, however, there being neither east nor west. In European countries the East, also called the Orient, signifies the countries of Asia lying east and southeast of Europe. In the western parts of the United States the East is a colloquialism for the region east of the Mississippi River, more especially that north of Maryland and of the Ohio River.

**East Africa, British**, comprises an area of over 1,200,000 square miles, situated to the north of German East Africa and south and west of Italian Northeast Africa, and extending inland to the Congo State and the Anglo-Egyptian Sudan, but here the boundaries are not definitely settled. It has a coast line of about 450 miles, from the river Umba on the south to the river Juba on the north. This vast region has a population estimated at over 13,000,000, and includes Masailand and the Kenia Uplands, parts of Somaliland and Gallaland, lakes Rudolf and Stefanie, the Albertine head-waters of the Nile, Lake Albert, part of Albert Edward Nyanza, the northern part of Victoria Nyanza, the countries of Uganda, Kavi-rondo, Unyoro, Ankole, Koko, etc. Great Britain has authority also over the coast islands of Pemba and Zanzibar. In 1888 a charter was granted to a company called the Imperial British East Africa Company, from the initials of whose name the country was for a time called Ibea, and on this body devolved the preliminary work of opening up the whole country. In 1893, however, the company retired from Uganda owing to political and other difficulties, and the protectorate was declared in the following year over that portion of the country. In 1896 this Uganda Protectorate was extended to the neighboring regions of Unyoro, Usoga, Ankole, etc., and the whole district of Uganda is now placed under a commissioner resident at Entebbe, the administrative capital of Uganda. The province of Uganda is recognized as a native kingdom under a "Kabaka." For Europeans and non-natives of the Uganda Protectorate, justice is administered by the British consular courts. Ports have been established at various places, and are garrisoned mainly by Sudanese troops, part of whose duty is to restrain the Unyoro and other peoples from predatory incursions on their neighbor's territory. All the rest of the country, with the exception of the islands of Zanzibar and Pemba, constitutes the East Africa Protectorate, declared in 1895. (See EAST AFRICA PROTECTORATE.) In the interior are many extensive plateaus; the highest mountains of this part of Africa are Mt. Kenia (18,370 feet), Mt. Elgon, and in the extreme west Ruwenzori. The most important rivers are the Nile and its head-waters, with the Tana, Juba, and Sabaki, entering the Indian Ocean. A considerable trade is carried on chiefly with Great Britain and British India. The natives of Uganda and other parts show great skill in various arts, and great

## EAST AFRICA — EAST AFRICA PROTECTORATE

capacity for adaption to European conditions and customs. Zanzibar and Pemba are still ruled by a sultan, but form a British protectorate. Some German firms are now in trade here and some trade has been established with Persia and Arabia.

**East Africa, German,** the German possessions in east Africa, acquired in 1885-90, lying immediately to the south of British East Africa, and having an estimated area of about 400,000 square miles, and estimated population of 4,000,000, of whom 1,000 are Europeans. They are bounded on the north by a line running northwest from the Umba River to the eastern shore of the Victoria Nyanza, and continuing west from this lake to the Congo State. Lake Tanganyika forms the western boundary, and thence a line to Lake Nyassa and the river Rovuma form the southwestern and southern boundaries. In September 1894 it was agreed that the German-Portuguese frontier should follow parallel lat.  $10^{\circ} 40'$  S. from the coast to its intersection with the river Rovuma, leaving Kionga and the mouth of the Rovuma to Germany, and Cape Delgado to Portugal. Several stations have been established by the German East Africa Company. A narrow-gauge railway from the coast to lakes Victoria Nyanza and Tanganyika was projected in 1899. The products of the country are coffee, tobacco, cotton, ivory, caoutchouc, and gum. The highest mountain is Kilimanjaro, reaching 19,600 feet. Among the chief rivers are the Rovuma, Rufiji, Kingani, and Pangani, flowing to the Indian Ocean; the Kagera, Shimiyyu, and Ruwara flowing into Victoria Nyanza; and the Malagarazi flowing into Tanganyika. In the north there are several small lakes, and in the southwest the larger salt lake, Rukwa or Hikwa. On the coast the chief towns are Mikindani, Lindi, Dar-es-Salaam, Bagamoyo, Pangani, Wanga, and the English mission station Saadani. Inland there are Mpwapwa, Kanyenye, Tabora (Kazeh), Urambo, and Ujiji, the last named being situated on the shore of Tanganyika. The country is under an imperial governor.

**East Africa, Portuguese.** The possessions of Portugal, comprising the three provinces of Lourenço Marques, Mozambique, and Zambesi. Its coast line extends south from Cape Delgado, the southern extremity of the coast-line of German East Africa to Kosi Bay, just below Delagoa Bay, at a point separating British from Portuguese territory, as fixed by the Anglo-Portuguese agreement of 1891; the northern boundary is the river Rovuma, running west from Cape Delgado to Lake Nyassa. The frontier between German and Portuguese East Africa runs along parallel lat.  $10^{\circ} 40'$  S. from the coast to its intersection with the river Rovuma, leaving the mouth of the Rovuma and Kionga to Germany, and Cape Delgado to Portugal. The eastern boundary is the lake and British Central Africa, or the Nyassa Protectorate down to the junction of the Shiré with the Zambesi; while from that point the British South Africa Company's territory, including Mashonaland and Matabeleland, and the former South African Republic, form the boundary. Its area is about 3,000,000 square miles; population about 1,600,000. The principal exports are oilnuts and seeds, caoutchouc, and ivory. The Mozambique Company administers Sofala and Manica, the Nyassa Com-

pany has jurisdiction in the northern part between Lake Nyassa, the Rovuma, and the Lurio, and there is also a Zambesia Company. There is a railway from Delagoa Bay to Pretoria, and one from Beira to Fort Salisbury in the Transvaal. The coast-lands are low-lying and not very healthy, but in the region of the Namuli Mountains there is one of the finest and most beautiful tracts of country in the whole continent. There are several important rivers, including the Zambesi, Limpopo, Rovuma, Sabi, Pungwe, Lurio, Mtepesi, Lukuga, and many others. The most important towns are Lourenço Marques, Inhambane, Sofala, Beira, Quilimane, Chinde, Mozambique, Ibo, Zumbo, Tete, and Sena. Gold is found in the Manica region on the west, and has been worked by British capitalists.

**East Africa Protectorate,** British possessions in East Africa, extending about 400 miles along the coast north from Umba, at the mouth of the Umba River. The south boundary runs from Umba in a northwest direction to the intersection of the Victoria Nyanza with the first parallel of N. lat., skirts the north shore of the lake, and thence west to the boundary of the Congo Free State. The river Juba begins the north boundary, which from the intersection of the river with the 6th parallel of N. lat. runs to the 35th meridian E. lon., and follows that to its intersection with the Blue Nile; the Congo Free State and the west water-shed of the basin of the Upper Nile forming the west boundary. The total area is about 300,000 square miles, embracing a great part of Somaliland, the Equatorial province, Usoga, Unyoro, etc. It is subdivided so as to consist of seven provinces and a tract of unorganized territory in the northwest. The provinces are under a sub-commission, and are divided into districts and sub-districts. Nandi and Kericho were formerly under the eastern province of Uganda, but 1 April 1902, they were transferred to the East Africa Protectorate. Mombasa is the largest town and the capital of the whole Protectorate. Pop. of Mombasa 27,000. The population of the Protectorate is estimated at 4,000,000. The Imperial East Africa Company opened up the country, having in 1888 obtained a concession of territory from the Sultan of Zanzibar and a charter from the British government. An arrangement for buying them out, was, however, made in 1895. The chief ports are Mombasa, the capital, Lamu, Umba, and Kismayu.

The prevailing religious belief is paganism of some form, but a large number are Mohammedans. A number of Christian missions have been established, and elementary schools founded. Legislation is by ordinances made by the commissioner, the codes of India being followed as far as applicable. The higher courts are at Zanzibar and Mombasa. Slavery is legal on the 10-mile coast strip, but nowhere else under the Protectorate. The principal exports are ivory, rubber, grain, cattle, hides, horns, gum-opal, and fruits. The principal imports are: Manchester and Bombay goods, brass, wire, beads, and some provisions. Trade is chiefly under the control of the East Indian merchants. In 1901 the railroad from Mombasa to Kisumu on Lake Victoria was completed, and other railroads are in process of construction. Post-offices, telegraph lines and other public im-



## EAST ANGLIA—EAST INDIA COMPANIES

provements have been introduced and are being extended. See EAST AFRICA, BRITISH.

**East Anglia**, an ancient kingdom of England, its territory corresponding to what is now Norfolk and Suffolk counties. Redwald was its first historical king (593-615).

**East Aurora**, N. Y., village in Erie County, on the Western N. Y. & P. R.R., 18 miles southeast of Buffalo. The place is noted as the home of the colony of Roycrofters. (See ROYCROFTERS). It is a residential suburb of Buffalo.

**East Cape**, the name of the southeastern extremity of New Guinea, in Goschen Strait, and of the most easterly headlands of Madagascar; also on the North Island of New Zealand; also in Siberia, on Bering Strait, in lon. 169° 38' W., in the eastern extremity of Asia. The latter is a bold, rocky promontory, almost cut off from the mainland by swamps and shallow lakes. On the north side is a village, Uéde, of less than 100 huts, with a population of about 260.

**East Greenwich**, R. I., town, county-seat of Kent County; on Greenwich Bay, and the New York, N. H. & H. R.R. The manufactories are cotton and yarn mills; it has also a large cotton bleachery. Pop. 2,825.

**East Hampton**, N. Y., town in Suffolk County, in the eastern part of Long Island; on the Long Island R.R., about 122 miles east of New York. The first settlement was made in 1649 and the place was considered as belonging to Connecticut from 1657 to 1664 when it came under the jurisdiction of New York. It was the home of John Howard Payne (q.v.). Pop. 3,800. Consult: Gardner, 'Records of East Hampton'; Hedges, 'History of the Town of East Hampton.'

**East Hartford**, Conn., town in Hartford County, on the New York, N. H. & H. R.R. The railroad shops and paper-mills give employment to a number of people. Large quantities of tobacco and garden vegetables are raised on the surrounding farms. Pop. 6,500.

**East Humboldt Mountains**, a range of mountains in Nevada, principally in Elko County. Fremont's Pass is in these mountains. Their slopes have more and larger trees than some of the other mountain ranges in the vicinity.

**East India Companies**, the various European trading companies chartered by their respective governments for the control of their trade in India and the adjacent countries and islands. From an early period, the Italian republics had established a flourishing trade with these eastern dominions, which was interrupted by the Moslem conquest of Egypt and Constantinople, and the establishment of Turkish rule in Africa and Europe. Under these circumstances arose that spirit of maritime exploration in the 15th century for the discovery of a new passage to the Indies which resulted in the discovery of America by Columbus while seeking a westward route, and in Vasco da Gama sailing around the Cape of Good Hope and reaching the Malabar coast in 1498. This latter discovery gave a new impulse and direction to commercial enterprise and in nearly all the leading nations of Europe, steps were taken to participate in the advantages prospectively revealed in the opening up of this new ocean highway. The 16th century was marked by the Portuguese establishing themselves in India; by English efforts to discover over-

land and northern passages to India, which while fruitless in the latter direction gave rise to commercial relations with the northern coast of Russia; by the union of Portugal and Spain in 1580, and the war with England which closed the Spanish-Portuguese avenues for Indian produce to that country; and by the revolt of the Netherlands against Spanish dominion which gave a parallel check to the Dutch Indian trade. These two latter events compelled Holland and England to seek direct communication with India; in 1582, a Capt. Stephens was the first Englishman to reach India via the Cape of Good Hope, and in 1586 Sir Francis Drake and Thomas Cavendish followed by way of Cape Horn. In the following decade the great historical commercial corporations known as the Dutch and the English East India companies, were organized, and later were followed by Danish, French and Swedish enterprises.

The Portuguese East India Company was organized in 1587, when, owing to laxity in the official management of the trade developed since 1498, it was entrusted to a company of Portuguese merchants in consideration of an annual payment. The company had a turbulent existence, chiefly of conquest by the Dutch until its dissolution in 1640, since when the unimportant Portuguese settlements have been under crown administration.

The Dutch East India Company formed at Amsterdam in 1595 as "a company for remote parts," in 1602 amalgamated with several minor companies and received a charter conferring the exclusive privilege of trade to the East Indies for 21 years, with the necessary civil and military powers. It had a wonderfully prosperous career and its charter was extended to 1644, when French and English competition had made itself so felt that the Dutch company had difficulty in raising the government subsidy for a 21 years renewal of the charter.

The peace of Westphalia in 1648, ensuring the independence of Holland, inaugurated a new era of prosperity; the company colonized the Cape of Good Hope between 1650 and 1670; in 1658 captured Ceylon from the Portuguese; the same year took Formosa, from which they were driven three years later by a Chinese adventurer; in 1663 obtained possession of the chief Portuguese settlements along the Malabar coast, and in 1666 monopolized the spice trade by the capture of Macassar. Their charter was renewed periodically until 1776; in 1781 owing to the expenses of the prolonged struggle against English encroachment, the company had to be assisted with a government loan, and in 1795 the proclamation of the Batavian republic terminated its existence; in 1798 the mother-country assuming the administration of the company's former possessions.

The English East India Company formed in 1599 and chartered by Queen Elizabeth in 1600, under the title of the "Governor and Company of Merchants of London trading with the East Indies," was the most important, commercially and historically of the East India companies. The trading limits assigned by the charter for 15 years were "all the islands, ports, havens, cities, creeks, towns and places of Asia, Africa, and America, or any of them, beyond the Cape of Bona Esperanza to the Straits of Magellan, with the exception of such places as are already in possession of any Christian prince in league









# EAST INDIAN MANUFACTURES.



1. 2. Musical Instruments.
3. Bangle.
4. Pendant of a Necklace.
5. 6. Vases of Glazed Pottery.
7. Earring,
8. Engraved and Gilded Bottle.

9. Spearhead.
10. Dagger; from Khuttar.
11. Saw-edge Sabre.
12. Flint Matchlock.
13. Wooden Spoon.
14. Border of a Mat.

15. Symbol of Juggernaut.
16. Nose Ornament.
17. Printed Cotton.
18. Cotton Carpet.
19. Emblem of Jain Sect.
20. Illuminated Manuscript.



## EAST INDIA HOUSE—EAST LIVERPOOL

or amity with the British crown who shall refuse his consent to such trade." The company comprised 125 stockholders, including a governor and 24 directors elected annually to supervise the company's business. The early voyages of Lancaster, Beal, Best and others resulted in large profits; in valuable commercial treaties being entered into with native princes; and in English prestige being considerably enhanced throughout the Orient by naval and political successes over the Portuguese. The establishment of factories in various stations, however, excited the jealousy of the Dutch, who in 1623 massacred the members of the English factory at Amboyna, an atrocity for which Cromwell in 1654 compelled the Dutch government to cede an island and to pay a sum of \$1,500,000 as compensation to the victims' families. This incident inaugurated the struggle which resulted in the loss to the Dutch of all their possessions on the Indian peninsula. With periodical renewals of its charter, the company, overcoming all rivalry and opposition, maintained its position. From 1745 to 1761 it was engaged in a crucial fight throughout the Carnatic for supremacy with the French company established in 1664, and which under La Bourdonnais and Dupleix had obtained almost paramount power in India; Clive (q.v.) brought it safely through the struggle. It was with reluctance, however, that the company accepted the position which their victories over the French and the native states was forcing upon them of territorial magnates, and unconsciously, of founders of the British empire in India; especially when their growing political importance inspired the home government with a desire to control their company.

In 1766 the right of the company to acquire territorial possessions formed a subject of inquiry in the British Parliament; and a year later a resolution of the proprietors to raise their dividend to 12½ per cent was vetoed. The question of the political rights of the company being thus raised, the British ministry acted on their view of it by sending a crown plenipotentiary to India, and after a protracted struggle, a regulating act was passed in 1773 remodeling the powers of the company and placing it under the control of Parliament. The constitution of the councils of the presidencies was regulated and their superintendence assigned to a crown official, Warren Hastings (q.v.) being appointed first governor-general. A further act introduced by Pitt in 1784 modified the political power of the company by a board of control, to superintend, direct, and control all acts, operations, and concerns relating to the civil and military government or revenues of India. From this time the political power of the company was little more than nominal, the right of nominating its officials still remained with the directors, but the absolute right of recall was vested in the crown. The company's charter was renewed with a few changes in 1793 and subsequently at intervals of 20 years; in 1813 they lost the monopoly of the Indian trade, which under certain restrictions was thrown open to all British subjects; their right of exclusive trade was restricted to China, but in 1833 this monopoly was also abolished. Their charter was renewed for the last time in 1853; the Indian mutiny, 1857-8, discredited the company's administration, and in 1858 a proclamation at Calcutta announced that Queen Victoria had assumed the government of

India. The company continued to receive and distribute the dividends guaranteed by the government until the East India Stock Redemption Act became operative in 1874 when the company was dissolved.

The Danish East India Company, founded in 1618, dissolved in 1634, reconstituted in 1670, again dissolved in 1729, was succeeded in 1732 by the Danish Asiatic Company. This company had a prosperous career until the war between Great Britain and Denmark in 1801, when its trade declined and ended with the cession of Tranquebar and Serampore to Great Britain in 1845.

The French East India Company, known as "La Compagnie des Indes Orientales," was founded in 1664 by Colbert, minister to Louis XIV. It had extensive privileges, and in 1675 made a settlement at Surat, and in the following year at Pondicherry. It had a long and prosperous career, notwithstanding the loss of trading privileges at various periods and its connection with the Mississippi Bubble (q.v.). It reached the height of its prosperity under Dupleix and La Bourdonnais (q.v.), extending its operations until the Deccan and the Carnatic were practically under French control, when antagonism with the English under Clive, the recall of Dupleix, and practical abandonment by the French government, led to the dissolution of the company by royal decree in 1769.

The Swedish East India Company, founded at Gothenburg in 1741, was reorganized in 1806. Consult: Bruce, 'Annals of the East India Company' (1810); Stevens, 'Dawn of British Trade to the East Indies' (1886); Castonnet des Fosses, 'L'Inde Française avant Dupleix' (1887).

**East India House**, the home of the East India Company in Leadenhall Street, London, well known during the 17th century. Charles Lamb, James Mill, and John Stuart Mill had clerkships at East India House. See **EAST INDIA COMPANY**.

**East Indies**, a name given to what was once called the peninsula of Hindustan and Farther India, and includes also the Malay Archipelago. This name was given to distinguish the Indies reached by sailing east from the Indies (West Indies) reached by sailing west.

**East Lake**, Ala., town in Jefferson County, about seven miles northeast of Birmingham. Howard College was established here in 1841, under the auspices of the Baptist Church. In 1902 there were in this college 10 teachers and 120 students. Pop. 3,150.

**East Liverpool**, Ohio, city in Columbiana County; on the Ohio River, and on the Pennsylvania R.R., 45 miles west of Pittsburgh. It has freight packet connections with all important Ohio river ports, extensive china, porcelain, earthenware, terra cotta and glass works, foundries, and machine shops. It has the largest pottery works in the United States, natural gas furnishes light and fuel, and the water-works are owned by the city. It has good schools, one business college, three national banks, and daily and weekly newspapers. Under the charter of 1882 the government is administered by a mayor and city council elected biennially. Pop. (1900) 16,485.



## EAST LYNNE—EASTER

**East Lynne**, a novel by Mrs. Henry Wood, which appeared in 1861. It takes its name from the ancestral home of the heroine, Lady Isabel Vane. Several years after marriage, mistakenly doubting her husband's fidelity, she leaves him for another, but later returns in disguise as nurse to her own children, and on her death-bed receives his forgiveness. Although 'East Lynne' has little literary merit, it secured immediate popularity, has been through many editions on two continents, and proved extremely successful as an emotional drama.

**East Main**, a region of the Dominion of Canada which formerly belonged to the Hudson Bay Territory, but which is now in the Ungava District. It is a bleak and desolate country, yielding little to commerce but fish oil and a few furs.

**East Orange**, N. J., city in Essex County, on the main line of the Lackawanna R.R., and on a branch of the Erie R.R.; about 12 miles west of New York. It is a residential city, its population being made up largely of people who do business in New York and Newark. The city contains many handsome churches, and private residences, a public library, high and graded schools, a national bank, and weekly newspaper. Pop. (1900) 21,506.

**East Providence**, R. I., a town in Providence County, on the Seekonk River, and on the New York, New Haven & Hartford R.R. It lies directly opposite the city of Providence. East Providence and the town of Seekonk, Mass., were once a part of the old town of Rehoboth. The town has extensive chemical works, electrical and wire works, bleacheries, linen manufactures, and other industries. The government is administered by a town council, which elects a majority of the local officials. The council members are elected annually by popular vote. The town was incorporated in 1862. Pop. (1890) 8,422; (1900) 12,139.

**East River**, the strait connecting Long Island Sound and New York harbor, separating the boroughs of Manhattan and Brooklyn. It is about 10 miles long, and is navigable by the largest ships.

**East River Bridge**. See WILLIAMSBURG BRIDGE.

**East Saginaw**, Mich. See SAGINAW.

**East Saint Louis**, Ill., city in Saint Clair County on the Mississippi River and on the Baltimore & Ohio, Chicago, B. & O., the Illinois and other railroads, opposite Saint Louis, Mo., and connected with it by the Eads Bridge. This is an important railroad and industrial center, the converging point of all the railways, 22 in number, entering Saint Louis, Mo.; it is also the great livestock distributing center of the United States, there being large stock yards here, numerous packing-houses and kindred establishments. It also has the largest and most important horse and mule market in the world. As a manufacturing city it contains rolling mills, steel plants, iron works, locomotive and machine shops, glass factories, sugar mills, grain elevators, flour mills and manufactories of various wood products. Seven miles distant are the great fields of Illinois. In public buildings the City Hall, High School, Public Library, Roman Catholic Academy, and Business College are

notable examples. There are three national banks, and one daily and four weekly newspapers. The city has electric light, gas and water works plants and electric street car service, municipal and suburban. East Saint Louis was incorporated as a village in 1861, and as a city in 1865. It expended over \$5,000,000 for public improvements from 1890 to 1900. The city is governed by a mayor and city council, elected biennially. The minor municipal officials are likewise elected by the people. Pop. (1870) 5,664; (1880) 9,532; (1890) 15,000; (1900) 29,655; (1903) estimated 40,000.

JAMES W. KIRK,  
*Editor East Saint Louis Journal.*

**East/cheap**, at one time a large market in the east of London. It occupied what is now Billingsgate and Leadenhall market. Several streets or roads converged at the great square, then called Eastcheap. Two of those highways were the old Roman roads which extended northeast and northwest out of the city. Some of the old taverns, notably "Boar's Head," mentioned by Shakespeare and others of the English writers, were at Eastcheap. At the north end of London Bridge there is now a small street called Eastcheap.

**Easter**, the festival commemorative of the resurrection of Jesus Christ, is called in the Greek and Latin and in the languages derived from them *Pascha*, *Pasch*, *Pasqua*, *Pascua*, *Pâques*, etc., from the Chaldee word *Pascha*, the equivalent of the Hebrew *Pesach*: and that name recalls the act of the Destroying Angel in "passing over" the households of the Hebrews when he smote the Egyptians (Exod. xii.). In languages of Germanic origin the festival has a name *Ostara*, derived from the goddess of spring, in Teutonic mythology. Besides being commemorative of the resurrection of Jesus Christ the Easter festival is a memorial of the Christian passover—of the atonement wrought by the death of Christ upon the cross. At first the Christian passover was celebrated on the same day as the Hebrew, the 14th day of the month Nisan. But before long in the Church of Rome and in other churches of the Latin world, the observance was transferred to the Sunday next after the 14th Nisan; this doubtless primarily to make the difference between Judaism and Christianity.

The churches of Asia and some in the West which were founded by missionaries from the East, were slow to adopt the usage of Rome, and the diversity of usage gave rise to no little controversy; the westerns taunting the easterns with subservience to Judaic custom, and the easterns accusing the westerns of innovation and departure from the ways of Jesus Christ and his apostles. It was not till the year 235 that a general law of the Church was enacted at the Council of Nice prescribing for the universal Church a day for this solemnity. To the bishops of Alexandria was committed in permanence the task of computing for all the churches the time of Easter, that city being the metropolis of science in those times. But the Alexandrine Paschal Cycles fixing the date of Easter for a long course of years were unsatisfactory, being both obscure and incorrect, and hence were not accepted generally; and as a result, in 444, Rome observed 26 March as Easter Day, while Alexandria observed 23 April; and earlier,

## EASTER ISLAND — EASTERN QUESTION

in 387 Easter Day in Gaul was 21 March, in Italy 18 April, in Egypt 25 April. The churches in Great Britain and in Ireland were, like those of Gaul and Egypt, at variance with Rome, and from that circumstance has been rashly inferred an Oriental origin of the Gaelic, Scotie, and pre-Saxon British churches: in fact those churches were but adhering to an antiquated rule which they had received from Rome, but which Rome herself had abandoned having reformed her calendar. It was in 669 that Theodore, Archbishop of Canterbury, established the reformed Roman calendar in England. The movable feasts of the Roman Catholic and the Anglican churches are determined by the day of the month upon which Easter Day falls. (See CALENDAR.) The way by which Easter Day is now determined is that of the first Sunday after the paschal full moon (14th day of the calendar moon, or the full moon which happens upon or next after the 21st of March). If the full moon happens upon a Sunday then Easter Day is the first Sunday following.

**Easter Island**, an island in the South Pacific Ocean, lon. 109° 17' W.; lat. 27° 6' S. The surface is hilly and the soil fertile; yams and sweet potatoes are the principal crops. A number of remarkable sculptures have been found on this island, gigantic stone images. In 1888 Chile took possession of the island, and has since made it a penal settlement. Pop. about 1,500.

**Eastern Empire**, the ancient empire lasting from 394 A.D. to 1453 A.D., which had its metropolis at Constantinople as distinguished from the western empire with its capital at Rome. It is known also as the Byzantine empire, the Roman empire of the East, and the Greek empire. See BYZANTINE EMPIRE.

**Eastern Question**, The, the name originally given to the diplomatic and national interests affected by the gradual retrocession of the Turkish empire in Europe, and the problem of disposing of the territory thus left, or presumably to be left. Bulgaria, Rumania, Servia, and Greece are the new states which have naturally arisen on the withdrawal of the Turkish power, and their history in connection with the respective policies of England, France, Austria, and Russia toward them is the history of the phases of the "Eastern Question" so far. The Crimean war of 1854-6, with the Treaty of Paris which followed; the Russo-Turkish war of 1877-8, with the Treaty of Berlin; and the Greco-Turkish war of 1897, are among the notable events connected with this subject. British diplomacy on this question has mainly aimed at checking the attempts of Russia to extend her empire and strengthen her strategic position by the absorption of part or all of the territory now belonging to the decaying Turkish empire. Of late years, however, the meaning of the phrase has been much extended, and may now be said to embrace the problem of preventing the aggression of Russia, either in Europe or Asia, from becoming a menace to the authority or commerce of Great Britain. The Russo-Chinese phase of the subject is the most recent one, and arose after the Japanese triumph of 1895 had shown the essential military, naval, and administrative weakness of China. The Turkish atrocities in Armenia showed how jeal-

ous of each other the Great Powers are in connection with these questions.

Whenever any phase of the Eastern question is reopened, all the world is concerned, and Russia becomes particularly interested because the question affects her route to the sea, and what is more her relations with England, the United States, and others of the Great Powers. Austria is concerned because it affects her prospects among the Balkan states. France is concerned because it affects her commercial ambitions in the Orient, her claims in Africa, her route to the East, and the interests of Russia, her great ally. Germany is concerned because of her relations to Russia and France. England is concerned because of Russia and her own life-and-death interests as the maintainer of a world empire in the Suez canal. All the colonial interests in southern Asia and in Africa are concerned. International politics all over the world, whatever the apparent issue and habitat, are resolvable into some form of the Eastern question and stand in sensitive connection with this great political storm centre of the world, the *Ægean* and the Bosphorus. America is also concerned with the Eastern question in its larger bearings.

The struggle between Occidentalism and Orientalism, and who is to lead as champion of the former, constitutes what may be called the greater Eastern question. When one crosses the *Ægean*, which is at one part only 100 miles wide, or crosses the Bosphorus which is merely a broad river, deep and rich, flowing down out of the Black Sea, and comes to the shores of Asia Minor, one becomes aware that he has passed out of one world into another world. He has passed out of the Occident into the Orient. The contrast between them, one cannot mistake. The West is full of creation, progress, restlessness, achievement, failure, disappointment, exultation; the East abounds in quietism, resignation, and blissful stagnation. Those are the great outlines of the difference, but they are outlines which force an absolute frontier through life, through the nations of men. Greece stands there at the gateway, and whatever comes from Asia to Europe comes through it. This is the lesson of early European civilization; will, force, empire came down from the North; refinement and civilization moved back in the reverse of their track. The reaction from Alexander's onslaught on the East came late, but it came strong. It came in the form of Islam. Mohammedanism is inspired Orientalism. On came Islam in a mighty tide, seeming, as it were, to have gathered force from the strong impact of Alexander's onslaught a thousand years before, as well as from having been pent up under that tremendous pressure which the Roman empire urged on it for so long. It came on in a terrible tidal wave, swept across northern Africa, across Spain, half across France, all over Asia Minor, up into the map of Europe to the gates of Vienna, and buried old Greece under a terrible slavery for centuries.

That was the reverse tide. The reaction set in long ago. Spain was long since cleansed. The Balkan states have been freed; Greece since the twenties has been free. The Sick Man of Constantinople lingers there by slender footing. He stays where he is by the sufferance of the Powers, or rather as the Persian empire stood — namely, so long as the Greeks could

## EASTERN QUESTION

not agree among themselves about the leadership of Occidentalism. That is what we are waiting for now. Who is to be the leader, who is to be the champion of Occidentalism in the 20th century? This is the practical form in which the greater Eastern question is stated to us now.

First of all, Turkey commands our attention. She still sits at the old-time gate by the Bosphorus, and her guns at the fort at Kum Kaleh still command the entrance to the Dardanelles. As a state, Turkey is a heterogeneous assemblage of people under the absolute sway of the sultan. It is a government lacking altogether a sense for the right of a community to choose concerning its own government. It thoroughly represents the Oriental idea whereby government is transcendent, a power above and outside the people, and not imminent, a power within the people. Herein lies the application of the Occidental-Oriental antithesis to political institutions. Turkey, though thoroughly Oriental in its political ideas, maintains its place on Occidental soil because the forces of Occidentalism cannot agree among themselves as to leadership.

Among the various peoples and races whom the fate of history has assigned to Turkish sway are the Armenians. Though their proper district is a province in northeastern Asia Minor, they are found scattered all through the Orient, nearly a quarter of a million of them living in Constantinople alone, and constituting nearly a quarter of its population. The Turkish empire, however, in its lack of sense for what we call distributed government, has no place for their individuality in its scheme. They are to the Turks, as far as they possess individuality and the tendency to use it, simply a plague spot in the empire. Crete is another plague spot on the Turkish map. The population of the island is essentially Greek. Of the quarter million inhabiting it there are perhaps 50,000 Mussulmans, but all speak Greek. Since the 17th century it has been in the hands of Turkey. The insurrection of 1866-8 stirred profoundly the sympathy of Christian people, but the governments of Europe as represented by the Powers insisted, even with a severe menace to Greece, in maintaining the *status quo* of Turkish possession. Repeated insurrections have taken place, notably those of 1891 and 1896; indeed the island has been in a perpetual state of unrest during most of the past century. Various promises of reformed administration have been at different times made by Turkey, but no satisfactory government has resulted. Turkey is unable to administer government. To the Turk the Greek is what the Armenian is—a nuisance. Similar conditions exist in the coast districts of Macedonia and in Epirus, though in the latter the discontent is not so acute or so well formulated. In both, the prevailing population is Greek, and the language, even of the Mussulman, in the latter, Greek. The unnaturalness of the situation teaches that postponement of a settlement can only be temporary. The greatest apprehension attaches to any consideration of any change whatsoever in the existing status. The moment the dismemberment of the Turkish empire in Europe begins, a long list of long-filed claims must be considered. They are unwilling to recognize preferred creditors. Crete, too, lies on

the route to the Suez Canal. It is possible there are other ambitions than those of Greece.

The Greeks are a people that must be reckoned with in the future settlement of Eastern questions. Commercial interests around the entire line of the Ægean are largely in Greek hands. More than one fourth of the population of Constantinople itself is Greek. Now that the Greek state has been created, it constitutes a rendezvous and point *d'appui* for the sentiment of nationality among the scattered millions of Greek blood and language. The Greek nation itself is bankrupt. The land offers no great hope of greatness under present day conditions. It is not suited to agriculture. It has neither water power, minerals in abundance, nor coal supply. But it has an energetic, active, optimistic, though restless and impulsive and, as yet, half-educated people. They are abstemious and thrifty. In foreign lands they accumulate wealth. They are profoundly patriotic. All the traditions of their glorious past are molded into the substance of their modern national life. They are thorough Occidentals, and their antagonism to Orientalism, both in spirit and in the concrete forms of Turkey and Turks, is thorough. The fight with them is on and it will last to the death, because it is grounded in an indestructible difference of thought, mood, and character.

Among the small states of the Balkan peninsula, Bulgaria is now the one developing most rapidly in strength and prestige. She has become the rival of Greece among the lesser states. They both look with greedy eyes toward Macedonia, whose inland population is Slavic, but whose coast population is Greek. Bulgaria is now reconciled with Servia and Montenegro, and by the formal act of allowing the baptism of the crown prince into the eastern Church sealed her acceptance of Russia's headship. As the Prince of Bulgaria said on the occasion of the baptism, "I turn my face toward the East." All the Balkan states, with the exception of Rumania, have, therefore, now virtually accepted the suzerainty of Russia. Rumania, in her isolation, has re-established friendly relations with Greece.

Austria of all the great powers fears most acutely the reopening of the Eastern question. The Slavic-Balkan states, consolidated now under Russia's protection, interpose between her and the Ægean a solid wall. It has been her eager ambition to secure a port on the Ægean (Salonica), and a right of way to it. She has now no chance. Any dislodgment of conditions in the Orient at this time could bring her no good, and would produce only relative injury.

Germany utilizes her influence as a power apparently in Russia's interest, so far as the Eastern question is concerned. She stands between France and Russia. If both are hostile she is lost. It is, therefore, her policy to trade the interests of the East for Russian favors. The failure of England's effort a year ago to extort reforms from the sultan was due more or less directly to Germany's duplicity. Germany played secretly Russia's game, with the result that Turkey became a province of Russia. This brings us to Russia.

Russia seems to-day the destined possessor. She was once at its gates, and only England's intervention kept her out. England's prestige in the Orient has suffered severe loss by the

collapse of her Armenian policy. Russia has made steady gains. The Slavic-Balkan states are her children, first by natal claims, for she freed them; now by formal diplomatic recognition. They are closing in steadily about Constantinople. Turkey herself has become virtually a Russian province. Russia has besides a natural geographic claim. So great a power as that cannot be cooped up away from the seaboard. The Bosphorus is her natural exit. She is a great world-power, bestriding Europe and Asia. France and China, as well as Turkey, are her allies, almost her provinces. She is immensely strong in her position for diplomatic aggression, because her whole power can be swung by a single hand. Safe in her position, unmenaced from the rear, she has only to bide her time, and as occasion offers to push forward. She is strong furthermore in a certain sympathy her semi-barbarism has with that of the border peoples of Asia. The peoples of the East always prefer the Russian to the Englishman. Russian diplomacy understands the Oriental use of language. Language is used by the Oriental for the purpose of producing kindly feeling or inducing another mortal to see things as you do, but certainly not for the purpose of reporting on objective verities. It is a mechanism for reporting on the greater subjective verities. The Englishman is not liked, though England is everywhere highly respected, feared, and trusted.

Constantinople has been for the last dozen years systematically fortified against the English but not against Russia. A Russian army can enter Constantinople at will. When the question of forcing the Dardanelles with an English fleet was agitated, the English naval authorities estimated that of the 19 ships lying at Salonica, 6 must be sacrificed to do it. The cards have been stacked for Russia. It looks to-day as if the ultimate occupation of Constantinople by Russia were a foregone conclusion. The opening of the Suez Canal has changed things, and as if by jealous interposition of geographic fate, drawn the issue back to the old fighting ground in the eastern Mediterranean. England must, if she is to hold India and Australia, control the Suez Canal and its approaches. England stands in political isolation, a grand isolation, strong not by alliances, but in and by her own intelligence, rectitude, and Anglo-Saxon grit. Within the last five years England has made up her mind that she must be strong enough, if necessary, to face all Europe single-handed. Within that time her navy has been doubled in strength. She is preparing for an inevitable conflict. The conflict concerns this question: who is to be the leader and champion of Occidentalism in the 20th century? Shall it be the Anglo-Saxon or the Slav?

The world is arraying itself in two great camps. Russia spans the north from China to France, and guiding the foreign policy of Germany rules in the last decision northern Asia and all Europe, except England and Italy. England spans the seas and holds in a mysterious bond of common interest and guaranteed justice the diverse elements of her world-empire. Russia's strength has been possibly greatly overestimated. The bonds which hold her empire together might weaken under the testing of adversity. Those which bind the British empire together would strengthen. The financial difficulties which Russia would face in the event

of a great struggle are an element of great weakness in her situation. England's resources are unlimited, infinitely varied and self-supplied. The power of the British empire as it is now organized has never been called to the test. It is no longer a question merely who shall hold Constantinople or who shall control the Suez Canal, who shall command the pass of Thermopylæ, or who shall control the oracle of Delphi. It is a larger question, and it concerns larger interests. It concerns the habitable globe.

See BALKANS; DARDANELLES; RUSSIA; SUEZ CANAL; TURKEY, etc.

*Bibliography.*—Baker, 'Turkey in Europe' (1877); Berner, 'Die Orientfrage' (1878); Boulger, 'England and Russia in Central Asia' Cuinèt, 'La Turquie d'Asie' (1891); Davis, 'Asiatic Turkey' (1878); Dollinger, 'Die Orientalische Frage' (1878); Freeman, 'Ottoman Power in Europe' (1877); Geary, 'Asiatic Turkey' (1879); Grosvenor, 'Constantinople' (1895); Marvin, 'The Russians at Merv and Herat' (1883); Thompson, 'The Outgoing Turk' (1897); Vambery, 'The Coming Struggle for India' (1885).

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**Eastern Rite, Churches of**, a name given to various bodies of Eastern Christians who are members of the Roman Catholic Church, but who have been permitted to retain many of their ancient customs, which differ from those in general use throughout the world. The Armenians, Coptics, Greeks, Maronites, and some others belong to the Eastern Rite. They differ from the Latin Church in nothing doctrinal, only in some matters of discipline. Their liturgy is in the language first used by their bishops and priests, and in no case is the Mass said in their vernacular of to-day. For instance, the Syrians use now the Arabic language (in some places modified) but the Maronite liturgy is in the old Syriac language, as used at the time of Christ. (See MARONITES.) They differ as to the manner of administering communion; some using for consecration only the leavened bread, others only the unleavened, and some giving communion to the laity under the form of both bread and wine, others using only one of the species as in churches of the Latin Rite. The discipline of marriage for the clergy differs from the Latin Church. Candidates for the priesthood may marry before becoming deacons, not after. All points of difference between the Eastern and Latin Rites are of discipline, not of faith.

**Eastern Shore**, a name given to all that part of Maryland lying east of Chesapeake Bay, and also the counties of Accomac and Northampton in Virginia. Delaware is sometimes included in the Eastern Shore. The country is noted for its fruit and for its mild climate. Great quantities of oysters are taken annually from the waters of the Eastern Shore lands.

**Eastern Star, Order of the**, a secret society composed exclusively of Freemasons in good standing, and their wives, mothers, sisters, and daughters, and the widows of Freemasons. The order originated in New York 1868. In 1901 there were 28 grand chapters in as many States, and nearly 100,000 members. Its rites and services are conducted with all the impressive se-

## EASTERN STATES—EASTMAN

crecy peculiar to Freemasonry. A five-pointed star, between whose points the word "Fatal" is inscribed, is the badge of the order.

**Eastern States**, in popular parlance, the six New England States—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut; in the Mississippi valley the inhabitants refer to the Eastern States as that section lying east of the Alleghany Mountains.

**Easthampton**, Mass., town in Hampshire County; on the New York, N. H. & H., and the Baltimore & M. R.R.'s; 12 miles northwest of Springfield. The chief manufactures are cotton goods, yarns, buttons, shoe-web, rubber and elastic goods. Williston Seminary, a preparatory school for boys, is located here. Easthampton was settled in 1665; and on 13 May 1704 an Indian attack upon the settlement resulted in 19 killed and much loss of property. Three villages are included in the town of Easthampton. Pop. 5,700.

**Eastlake**, Sir Charles Lock, English artist: b. Plymouth 17 Nov. 1793; d. Pisa, Italy, 23 Dec. 1865. He entered the schools of the Royal Academy, where Haydon supervised his education. In 1816 he went to Italy, and for 14 years his home was at Rome, his Italian life being broken by visits to England and Greece. Pictures of banditti and other subjects exhibited in England procured him the associateship of the Academy in 1827. 'Pilgrims Arriving in Sight of Rome' (1828) became so popular that the artist became tired of repeating it in different versions. In 1830 he was made an R.A., his diploma picture being 'Hagar and Ishmael.' 'Escape of Francesco Carrara' (1834); 'Gaston de Foix' (1838); 'Christ Blessing Little Children' (1839); and 'Christ Weeping Over Jerusalem' (1841), were next among his noteworthy productions. 'Helena' (1849); 'Ippolita Torelli' (1851); 'Violante' (1853); may also be mentioned. He translated Goethe's 'Theory of Colors' (1840), and published in 1847 'Materials for a History of Oil-painting.' He became president of the Royal Academy in 1850, being knighted on the occasion; was keeper of the National Gallery in 1843-7, and director of the same institution from 1855 onward.

**Eastlake**, Charles Locke, English art critic: b. Plymouth, England. He studied in the Royal Academy schools, but subsequently devoted himself to literary work and design, and was keeper and secretary of the National Gallery 1878-98. He has published: 'History of the Gothic Revival in England' (1871); 'Hints on Household Taste' (4th ed. 1874), a book which exerted much influence in its day; 'Lectures on Decorative Art and Art Workmanship' (1876); 'The Present Condition of Industrial Art' (1877); 'Our Square and Circle' (1895); 'Pictures at the National Gallery' (1898).

**Eastman**, Charles Alexander, American homœopathic physician, and author: b. Redwood Falls, Minn., 1858. His father was a Santee-Sioux Indian, Many Lightnings (Jacob Eastman), and his mother a half-breed Sioux, Nancy Eastman. He was graduated at Dartmouth College 1887, and at the Boston University School of Medicine 1890. He married the poetess, Elaine Goodale, 1891. He served as government physician at Pine Ridge Agency 1890-3, being Indian secretary of the Y. M. C. A. 1894-7. He

acted as attorney for the Santee Sioux at Washington 1897-1900, later becoming government physician at Crow Creek, South Dakota. He published 'An Indian Boyhood: or Recollections of a Wild Life' (1901).

**Eastman**, Charles Gamage, American poet: b. Fryeburg, Me., 1 June 1816; d. Burlington, Vt., 1861. He published (1848) a volume of 'Poems' descriptive of rural life in New England, and edited the Vermont *Patriot* at Montpelier from 1846 until his death.

**Eastman**, Charles Rochester, American palæontologist: b. Cedar Rapids, Iowa, 5 June 1868. He was graduated at Harvard University in 1890. Subsequently he served on the United States and Iowa State geological surveys; and was an instructor in geology and palæontology in Harvard and Radcliffe colleges. He afterward took charge of the department of vertebrate palæontology in the Agassiz museum at Harvard. He published an English translation of Von Zittel's 'Palæontology' (1901). In 1901 he was tried for the murder of his brother-in-law, and acquitted.

**Eastman**, George, American inventor: b. Waterville, Oneida County, N. Y., 12 July 1854. As an amateur photographer in Rochester, N. Y., he turned his attention to the production of dry plates, which achieved an instantaneous success. In 1881 the Eastman Dry Plate Company was organized, which developed later into the Eastman Kodak Company. Eastman companies have also been established in London, Paris, Berlin, and elsewhere, and the business has now reached vast proportions.

**Eastman**, Harvey Gridley, American educator: b. Marshall, N. Y., 1832; d. 1878. In 1859 he founded the Eastman National Business School at Poughkeepsie, N. Y.

**Eastman**, John Robie, American astronomer: b. Andover, N. H., 29 July 1836. He was graduated at Dartmouth College in 1862; and became assistant in the United States Naval Observatory. In 1865 he was appointed professor of mathematics in the navy. He has been a member of several astronomical expeditions in the United States, and accompanied one to Sicily in 1870. Most of his observations, computations, and researches appear in the annual volumes of the 'Naval Observatory,' which, in 1872-82, were edited by him.

**Eastman**, Julia Arabella, American writer for juveniles: b. Fulton, N. Y., 17 July 1837. Among her writings are: 'Short Comings and Long Goings' (1869); 'Beulah Romney' (1871); and 'Young Rick' (1875).

**Eastman**, Joseph, American physician: b. Bleeker Mountains, Fulton County, N. Y., 1842. He learned blacksmithing, served for a time as a private in the Federal army during the Civil War, subsequently studied medicine, and has long been prominent as a physician in Indianapolis, his specialty being abdominal and pelvic surgery.

**Eastman**, Mary Henderson, American prose writer: b. Warrenton, Va., 1818. She has published: 'Dacotah or Life and Legends of the Sioux' (1849); 'Romance of Indian Life' (1852); 'Tales of Fashionable Life' (1856); and many stories and sketches.



## EASTON—EATON

**Easton, Nicholas**, American colonial statesman: b. Wales 1593; d. Newport, R. I., 15 Aug. 1675. Emigrating to America in 1634 he was the first settler in Agawam, now Newbury, Mass., 1635. He built the first English house in Hampton, N. H., 1638, and the first one on the site of Newport, R. I., 1639, and was elected president of Providence Plantations 1649 and 1654. He was deputy-governor of Rhode Island for four years, and governor 1672-5.

**Easton, ēs'tōn**, Md., town, county-seat of Talbot County; on the Philadelphia, W. & B., and the Baltimore, C. & A. R.R.'s; about 28 miles southeast of Annapolis. The manufactures are chiefly iron machinery, fertilizers, carriages, wagons, lumber, flour, canned fruits, furniture, and shirts. Pop. 3,124.

**Easton, Mass.**, town in Bristol County, on the New York, N. H. & H. R.R., about 25 miles south of Boston. There are several villages included in this town. The manufactures are chiefly shovels, machine-shop products, hardware, shoes, wire, and automobiles. Pop. 4,912.

**Easton, Pa.**, city, county-seat of Northampton County; on the Delaware at the mouth of the Lehigh River; on the Pennsylvania, the Lehigh V., the Central of N. J., and other railroads; 75 miles southwest of New York, and 60 miles north of Philadelphia. The coal and slate found in the vicinity in large quantities affects the industries of the place. Its manufactures are mining implements, railroad supplies, boots, shoes, hosiery, organs, and other articles. The mayor is elected every three years. Pop. 25,300.

**Eastport, Maine**, city and port of entry in Washington County, on Moose Island, in Passamaquoddy Bay, and on the Washington County R.R.; 190 miles east-northeast of Portland. It is the northeast frontier city of the United States, and has a fine harbor, with daily steamship service with Boston, Calais, and Portland. The city has extensive fishing and ship-building interests, a sardine-packing establishment with 20 factories, public high school and library, national and savings banks, weekly newspapers, and electric lights. Pop. 5,500. Consult: Kilby, 'Eastport and Passamaquoddy.'

**Eastward Position**, the position assumed by many clergymen of the Anglican Church during part of the communion service, the clergyman being placed in front of the communion table with his back to the congregation. This position has been a cause of much controversy. It was decided, in 1870, that such a position during the prayer of consecration is illegal; but if the "manual acts" of the priest are visible, the position appears to be legal by a decision of 1891.

**Eastwick, Edward Backhouse**, English Orientalist, and diplomatist: b. Warfield, Berkshire, 13 March 1814; d. Ventnor, Isle of Wight, 16 July 1883. He was a voluminous writer on Oriental (especially East Indian) subjects, and rendered very important service to English literature by many translations from Persian and Hindu, for example: Sadi's 'Gulistan,' or 'The Rose Garden' (1852); and the version of Pilpay's fables called 'Anvār-i-Suhail' (1854). He also wrote a 'Journal of a Diplomat's Three Years' Residence in Persia' (1864); and 'Ven-

ezuela,' or 'Sketches of Life in a South American Republic' (1868). Between 1878 and 1882 he brought out a sumptuous edition of the 'Kaisar-nama-i-hind,' or 'Lay of the Empress.' He was a frequent contributor to literary journals.

**Eaton, Amos**, American scientist: b. Chatham, N. Y., 1776; d. 1842. He was graduated at Williams College 1799; settled in Catskill, N. Y.; practised law, and engaged in civil engineering, while prosecuting studies in chemistry, geology and mineralogy. He made a survey of Albany and Rensselaer counties 1820, and later of the Erie Canal region. Among his works are: 'An Index to the Geology of the Northern States' (1818); 'A Manual of Botany of North America' (1833); and 'Geological Note-Book' (1841).

**Eaton, Amos Beebe**, American army officer: b. Catskill, N. Y., 1806; d. 1877. He was graduated at West Point, and after serving on the northern frontier received the brevet of major 1847. He served as purchasing commissary at New York during the Civil War, and was brevetted major-general 1865.

**Eaton, Arthur Wentworth Hamilton**, Canadian writer: b. Kentville, Nova Scotia. He was graduated from Harvard in 1880, entered the Episcopal ministry, and was rector of St. Andrew's Church, Chestnut Hill, Mass., 1885-7. Since 1888 he has been an assistant master in the Cutler school for boys in New York. He is the author of 'The Heart of the Creeds: Historical Religion in the Light of Modern Thought' (1888); 'Arcadian Legends and Lyrics' (1889); 'Letter Writing: Its Ethics and Etiquette' (1890); 'The Church of England in Nova Scotia, and the Tory Clergy of the Revolution' (1891); 'Tales of a Garrison Town' (with C. L. Betts) (1892); 'College Requirements in English' (1900).

**Eaton, Charles H.**, American Universalist clergyman: b. Beverly, Mass., 15 Aug. 1852. He is a graduate of Tuft's College 1874, and of Tuft's College divinity school 1877. He was ordained at Palmer, Mass., 1877; and in 1881 became pastor of the Church of the Divine Paternity in New York 1881, succeeding Rev. E. H. Chapin.

**Eaton, Charles Warren**, American artist: b. Albany, N. Y., 22 Feb. 1857. He studied at the National Academy of Design, and the Art Students' League, New York, and in London; and is a member of the American Water Color Society, New York. He exhibited at the Paris Exposition 1900.

**Eaton, Daniel Cady**, American botanist: b. Fort Gratiot, Mich., 12 Sept. 1834; d. New Haven, Conn., 29 June 1895. He was a grandson of Amos Eaton (q.v.); was graduated at Yale College in 1857, and professor of botany there 1864-95. He accompanied the government expedition to the Wasatch Mountains in Utah. His best-known publications are: 'The Ferns of North America'; and 'Ferns of the Southwest.'

**Eaton, Dorman Bridgman**, American lawyer: b. Hardwick, Vt., 27 June 1823; d. New York 24 Dec. 1899. He was graduated at the University of Vermont in 1848, and at the Harvard Law School in 1850; was admitted to the New York bar; and later became widely known by his advocacy of civil-service reform. In 1883



he was appointed a commissioner of the United States Civil Service Commission, resigning in July 1885. He was reappointed in November of the same year, but again resigned in April 1886. In the latter year he drafted the laws which created the Metropolitan Board of Health of New York; subsequently those on which the present police courts were organized; and in 1883 the National Civil Service Act. His publications include: 'The Independent Movement in New York' (1880); and 'Civil Service in Great Britain' (1880). He also edited the 7th edition of Kent's 'Commentaries.'

**Eaton, John**, American educator: b. Sutton, N. H., 5 Dec. 1829. He was graduated at Dartmouth College in 1854; studied theology; and in 1862 became chaplain of the 27th Ohio Volunteer infantry. Subsequently he was appointed superintendent of freedmen for Mississippi, northern Louisiana, Arkansas, and west Tennessee, and remained on duty till May 1865. He was brevetted brigadier-general of volunteers in 1865. In 1871-86 he was commissioner of the United States Bureau of Education; in 1895 became president of Sheldon Jackson College at Salt Lake City; and in 1898 was appointed a special commissioner to arrange for the establishment of the American system of education in Porto Rico. His publications include: 'History of Thetford Academy'; 'Mormons of To-day'; 'The Freedmen in the War' (report); 'Schools of Tennessee' (report); and reports of the United States Bureau of Education.

**Eaton, John Henry**, American statesman: b. Tennessee 1790; d. 1856. He practised law in Nashville, and was secretary of war 1829-34, when he became governor of Florida. He was appointed minister to Spain 1836, and published a 'Life of Andrew Jackson' (1824).

**Eaton, Margaret O'Neill** ('PEGGY O'NEILL'): b. Washington 1796; d. 1879. As the wife of Major J. H. Eaton, Jackson's secretary of war, she was the subject of a social war in government circles owing to certain charges connecting her name with that of Major Eaton, while she was still wife of purser Timberlake, her first husband. It was said that from this social disturbance arose an estrangement between Gen. Jackson and Calhoun, leading to the nomination of Van Buren for the presidency 1836. After the death of her second husband she married a third, an Italian dancing-master, much her junior, from whom she was divorced.

**Eaton, Seymour**, American editor and author: b. Canada 1859. He served for five years as director in the Drexel Institute, and was director of the Home Study Circle of the Chicago *Record* for several years. He is widely known as the founder and president of the Book-lovers' Library. Among his works are: 'Business Forms'; 'How to do Business'; 'The New Arithmetic.'

**Eaton, Theophilus**, American colonial governor: b. Stony Stratford, Buckinghamshire, England, about 1591; d. New Haven, Conn., 1658. He came over to Massachusetts with the Rev. John Davenport, 1737, founding with Davenport the town and colony of New Haven, in 1638. He was chosen governor October 1639, and re-elected annually as long as he lived. He was prominent in the organization of the New

England Confederation 1634, and the so-called Connecticut "Blue Laws" were drawn up by him, assisted by Davenport, 1655.

**Eaton, Thomas Treadwell**, American Baptist clergyman, and author: b. Murfreesboro, Tenn., 16 Nov. 1845. He was graduated at the Washington and Lee University 1867; was ordained (1870) to the Baptist ministry, holding pastorates successively at Lebanon, Chattanooga, Tenn.; Petersburg, Va., and Louisville, Ky. Since 1887 he has been the editor of the 'Western Recorder.' Among his works are: 'The Angels' (1873); 'Talks to Children'; 'Talks on Getting Married'; 'The Bible on Women's Public Speaking'; 'Wives and Husbands'; 'The Theatre'; 'How to Behave as a Church Member'; 'Conscience in Missions'; and 'Faith of Baptists.'

**Eaton, William**, American officer: b. Woodstock, Conn., 23 Feb. 1764; d. Brimfield, Mass., 1 June 1811. He served in the army 1780-3, and then went to Dartmouth College, where he was graduated 1790. Becoming captain in the United States army in 1792, he served in campaigns against the Indians till 1798, when he was sent to Tunis as American consul. During the war against Tripoli in 1801 he resolved to re-establish Hamet Caramelli as Bey of Tripoli, but was not supported in his attempt by the American naval officers. He returned to America in 1803, and was subsequently appointed naval agent of the United States for the Barbary powers. Returning to Africa he captured the city of Derne 27 April 1805, but the United States concluding a treaty of peace with the usurper Yussuf, Eaton returned to America in the autumn of 1805. The State of Massachusetts granted him an estate of 10,000 acres in Maine.

**Eaton, William Wallace**, American politician: b. Tolland, Conn., 11 Oct. 1816; d. Hartford, Conn., 19 Sept. 1898. He received a common school education; became a lawyer; and settled in Hartford in 1850. During the Civil War he was called a "Peace Democrat," and urged resistance to any Massachusetts troops passing through Connecticut. He was a member of the United States Senate in 1875-81; and of the House of Representatives 1883-5.

**Eaton, Wyatt**, American artist: b. Phillipsburg, Quebec, 6 May 1849; d. Newport, R. I., 7 June 1896. After studying in New York, and abroad, he returned to the United States in 1876, and settled in New York. He was one of the founders of the Society of American Artists and later served as its secretary and president. His works include portraits of Bryant, Longfellow, Emerson, Whittier, Holmes, etc.

**Eaton, Ohio**, village, county-seat of Preble County, on the Pittsburg, C. & St. L. R.R. It is a trade centre for an agricultural section. Pop. 3,246.

**Eatonton**, ē'ton-tón, Ga., city, county-seat of Putnam County; on the Central of Ga. R.R.; about 68 miles southeast of Atlanta. It is the trade centre for a section in which are raised fruit, and cotton. Its manufactures are dairy products, and cotton goods. Pop. 2,000.

**Eau**, ô, a French word signifying water, and used in English with some other word for several spirituous waters, and particularly perfumes: (1) *Eau de Cologne*, a fragrant water

made originally and in most perfection in Cologne. It was invented by Farina. (2) *Eau Cr  le*, a highly esteemed cordial made in Martinique, West Indies, by distilling the flowers of the mammee apple with spirit of wine. (3) *Eau de Javelle*, a preparation of chloride of soda, used as an antiseptic, and a bleaching agent. (4) *Eau de Luce*, invented by a person named Luce, at Lille, in Flanders, is a volatile preparation, made from oil of amber, alcohol, and ammonia. It is a milky fluid, powerfully antispasmodic, and stimulant. Mixed with nitric acid it forms a substitute for musk. (5) *Eau de Paris*, a substitute for cologne, and which is sometimes taken in sweetened water as a cordial, and stimulant. (6) *Eau de Vie*, a brandy; specifically the less perfectly purified varieties, the best being called cognac. (7) *Eau de vie de Dantsig*, a white liqueur, or cordial, sweet and strong, in which are introduced for ornament small particles of gold-leaf. (8) *Eau de vie d'Hendaye*, a sweet French cordial, of which there are three varieties—white, green, and yellow.

**Eau Claire**,    kl  r, Wis., city, county-seat of Eau Claire County, at the mouth of the Eau Claire River, and the head of navigation of the Chippewa River, and on the Chicago & N.; Wisconsin C., and several other railroads; 85 miles east of St. Paul, and 150 miles northwest of Madison. It is the commercial centre for northwestern Wisconsin, and the outlet of the Chippewa lumber district, with extensive water power. It has a great trade in lumber, and manufactures over 300,000,000 feet annually. There are extensive manufactures of iron and linen goods, furniture, machinery, and shoes. The city is noted as a summer resort, and has electric railroads, and street lights, waterworks, public library, and high school, Sacred Heart Hospital, national and savings banks, daily and weekly newspapers. Pop. (1900) 17,600.

**Eaux-Bonnes**,   -b  n, France, a celebrated watering-place, department Basses-Pyr  n  es, at the bottom of a narrow gorge, about 25 miles south of Pau. The springs, which have a temperature of about 90  , are strongly impregnated with sulphur. About 6,000 to 10,000 visitors resort hither in the course of the season, which lasts from June to October. Pop. (1891), 735.

**Eaux-Chaudes**,   -sh  d, France, a watering-place in France, three miles southeast of Eaux-Bonnes. Some of its springs have the same properties as those of the Eaux-Bonnes, and others are more strongly impregnated with sulphur.

**Eaves or Cliff Swallow**, one of the familiar North American swallows (*Petrochelidon lunifrons*) common about buildings where, as explained under BARN-SWALLOW, it has taken up its residence as fast as the country became settled. It is to be recognized by the squareness of the tail (not deeply forked as in its larger associate, the barn-swallow), the chestnut rump, whitish belly and blue spot on the breast. It is most peculiar, however, in its nests, which are always attached to the outside of the building, and usually in close row under the protection of the eaves. These nests are made of pellets of mud; are shaped like bulbous flasks with a curved neck forming an entrance; and are attached by their base to the

wall. In the primitive wilderness these nests are attached in crowded colonies to the faces of cliffs, where whole masses would frequently scale off by reason of the weight or of the loosening action of rain. Much safer and better conditions are found under the protection of the eaves of buildings; and not only has this swallow everywhere taken advantage of this fact, but striking modifications in their architecture have followed. The eggs closely resemble those of the barn-swallow, and two broods are usually raised. The species abounds in suitable localities all over the continent, migrating to the tropics in winter.

**Eaves'drip**, an ancient custom, or law, corresponding to the well-known urban servitude of the Romans called stillicide, where a proprietor was not allowed to build to the extremity of his estate, but must leave a space regulated by the charter by which the property was held, so as not to throw the eavesdrop on the land of his neighbor.

**Ebal**,   'bal, a mountain in Palestine, nearly 3,000 feet in height: 35 miles north of Jerusalem, situated north of Mount Gerizim, from which it is separated by a narrow valley containing the town of Nablus, anciently Shechem. Here the Israelites were commanded, on their entrance into the Holy Land, to set up an altar to Jehovah of hewn stones. The fulfillment of this is recorded in Joshua (viii. 30-35). From Mount Ebal the curse for disobedience to the law was pronounced, the blessing for obedience being given from Mount Gerizim, which lies across the valley. The modern Arabic name of Ebal is Jebel Eslamiyah.

**Ebel'ians**, German sect, named after Ebel, a Prussian archdeacon, one of the founders. It arose in K  nigsberg, Prussia, about 1836, the Archdeacon Ebel and Dr. Diestel being its leaders. They believed in spiritual marriage. In 1839 sentence was passed against their leaders, who were charged with unsound doctrine and impure lives, but it was removed in 1842. Their enemies called the sect Mucker, that is, in German, hypocrites.

**Ebeling**,   'bel-  ng, **Christoph Daniel**, German scholar: b. Garmissen, near Hildesheim, Hanover, 20 Nov. 1741; d. Hamburg 30 June 1817. He was noted for his extensive knowledge of Oriental languages, of classic and foreign literature, and of history and geography. He published a history and geography of North America (1796-1816), for which he received a vote of thanks from the United States Congress. He paid special attention to the geography of the New World, and collected about 10,000 maps and nearly 4,000 books, all relating to America. This library was purchased in 1818 by Israel Thordike of Boston, and presented by him to Harvard College.

**Ebenezer**,   b-  -n  'z  r (Heb. "the stone of help"), commonly used as any memorial of divine assistance, originally the name of a field where, at Samuel's request, the Lord discomfited the Philistines with thunder, etc. On this occasion Samuel set up a stone, and gave it this designation, to indicate that the Lord had helped them. The site has never been definitely ascertained.

**Ebensburg**, Pa., borough, county-seat of Cambria County; on a branch of the Pennsyl-

vania R.R., about 79 miles east of Pittsburg. The manufactories are woolen-mills, tanneries, saw-mills, and iron-works. It is about 2,300 feet above sea-level. Pop. 1,621.

**Eberhard, a'ber-härt, Christian August Gottlob**, German poet and descriptive writer: b. Belzig 12 Jan. 1769; d. Dresden 13 May 1845. His verse is a reminiscence of the 18th century style and of the school of Gleim, the idyl 'Little Hans and the Cookie' (1822); and 'Various Poems' (1833), eminently so. His best prose is in 'Italy as It Impressed Me' (1839).

**Eberhard, Johann August, yō-hän ow'-goost**, German philosophical writer: b. Halberstadt 31 Aug. 1739; d. there 6 Jan. 1809. He first attracted attention with a 'New Apology of Socrates' (1772), an attack upon the narrow theology of the day, to which succeeded 'Universal History of Philosophy' (1788); 'Handbook to Æsthetic' (1803-5); and other works from a Wolffian standpoint, in harmony with Leibnitz and in opposition to Kant.

**Eberle, a'ber-le, Robert**, German artist: b. Meersburg 22 July 1815; d. Eberfing, near Munich, 19 Sept. 1860. He was a pupil of Biderman and later of Van de Velde. His talent was particularly displayed in painting sheep. One of his works, 'A Shepherdess,' is in the Modern Gallery, Munich.

**Eberlein, Gustav**, German sculptor: b. Spierkershausen, Hanover, 1847. His chief work is a long frieze ornamenting the façade of the Ministry of Cults, Berlin, with 50 figures attending religion. He did other decorative work for the University of Kiel. Among his works are: 'Drawing out a Thorn'; 'Greek Flute Player'; 'Psyche,' and the 'Archer.' From his hand also are five allegorical groups at Stuttgart, and monuments of William I. at Elberfeld, Geisslingen, Mannheim, Altona, and Ruhrort, and one of Frederick I. in Berlin. He is the author of 'Aus Eines Bildners Seelenleben, Plastik, Materie und Poesie' (1892).

**Ebers, Emil, a'mēl ā bērs**, German artist: b. Breslau 14 Dec. 1807; d. Beuthen 1884. He studied at the Academy of Düsseldorf and early turned his attention to dramatic subjects such as scenes of battle in the Middle Ages, brigandage, sailors, fishermen, etc. In later years, after traveling much and visiting the shores of the North Sea, Holland, and Normandy, he devoted himself to marine painting exclusively. Among his works are: 'Smugglers About to Land' (1830), in the National Gallery, Berlin; 'Fisherman's Hut' (1831); 'Smugglers Surprised' (1832); 'Smugglers in Tavern' (1835); 'Repressing Revolt'; 'Dutch Smugglers on Coast of Normandy' (1842); 'Prussian Hussars Maltreating French Peasants' (1843); 'Life Boat' (1844); 'Pilot Boat' (1845); 'Storm on Inland Sea' (1845); 'Mutiny on Brig' (1848); and some historical paintings, such as 'St. Goar converting the Rhine Provinces.'

**Ebers, Georg Moritz, gā-örg mō'rīts**, German Egyptologist and novelist: b. Berlin 1 March 1837; d. Tutzing, Bavaria, 7 Aug. 1898. About 1859 he began to devote himself almost exclusively to Egyptological studies, and in 1868 was appointed extraordinary professor of the language, history, and antiquities of ancient Egypt at Jena. In the following year he traveled in Egypt, Nubia, and Arabia, and on his

return in 1870 became ordinary professor of Egyptology at Leipsic. Another visit to Egypt in 1872-3 resulted in the discovery of the important medical papyrus, now known by his name. Among his published contributions to Egyptology are: 'Disquisitiones de Dynastia vicesima sexta Regum Ægyptiorum' (1865); 'Ägypten und die Bücher Moses' (Vol. I, 1868, not completed); 'Durch Gosen zum Sinai' (1872); 'Papyrus Ebers' (1875); 'Eine Galerie antiker Portraits' (1889); 'Die hieroglyphischen Schriftzeichen der Ägypter' (1890); and 'Ägypten in Bild und Wort' (1878-9), translated into English as 'Egypt, Descriptive, Historical, and Picturesque' (1880). Besides these works he published many novels, mostly dealing with Egyptological subjects, among which are: 'Eine Ägyptische Königstochter' ('An Egyptian Princess' 1864); 'Uarda' (1877); 'Homo Sum' (1878); 'Die Schwestern' ('The Sisters' 1880); 'Der Kaiser' (1881); 'Serapis' (1885); 'Josua' (1889); 'Per Aspera' (1892); 'Kleopatra' (1894); and 'Arachne' (1897). He also published a poem called 'Elison' (1888), and an autobiography (1892), entitled 'Die Geschichte meines Lebens.' A collective edition of his works was published at Stuttgart (1893-7).

**Eberswalde, ā-bērz-vāl-de** (ancient NEUSTADT-EBERSWALDE), Germany, town on the Finow Canal, about 28 miles northeast of Berlin. It is a busy industrial centre, having a number of machine-shops, saw-mills, paper-mills, and iron-works, and doing a considerable trade in lumber and coal. There is here a royal academy of forestry. Eberswalde is a favorite summer resort for the people of Berlin. Pop. 18,500.

**Ebert, ā'bērt, Karl Egon**, Austrian poet and dramatist: b. Prague 5 June 1801; d. there 24 Oct. 1882. He began with dramas of Bohemian history, many of which were staged but only one printed, 'Wratislav and Jutta' (1835). As a lyric poet and balladist he was more successful; his 'Poems' (1824) contain fine lyrics, and 'Schwerting the Saxon Duke' is still high in popular favor. His longer poems — 'Vlasta: a National Hero-Poem of Bohemia,' and 'The Monastery,' are fluent in style as well as pure and elegant in language. 'A Monument to Karl Egon, Prince of Fürstenberg,' consists of a garland of sonnets; 'Devout Meditations of a Man of the World' is a didactic poem.

**Ebionites, ē'bi-ōn-its**, a sect composed of Jewish believers in Jesus of Nazareth as being the Christ or Messiah, who nevertheless retained many of the practices and beliefs of their ancestral religion. Their name, Ebionites, seems to be formed from the Hebrew word *ebionim*, poor folk; but some of the ancient writers, unacquainted with the history of the primitive church of Jerusalem and Judea and with the Hebrew language, derive the name from that of a supposititious heresiarch Ebion. If the name was originally *ebionim*, "the poor," the sect will have chosen for itself in effect the same name as the mediæval sect of the Poor Men of Lyons. The Ebionites are by many authors confounded with the Nazarenes or Nazarites, another body of Christians Jewish by race and in a measure also Jewish in religion. The rise of the Ebionite sect is commonly referred to the time of Trajan, when, the whole Jewish race being excluded

from Ælia Capitolina (as Jerusalem was named anew), these people, despised alike by Jews, Christians, and pagan Romans, migrated to Peræa, the country beyond the Jordan, and there freely developed their religious tenets and practices. They were Jewish rigorists, zealots, with some tinge of Christian belief, in that they held Jesus to have been the Messiah; but they held him to be only man and begotten like other men. The Mosaic law they believed to be of everlasting obligation upon all believers in Jesus Christ whether of Jewish or Gentile race. St. Paul they regarded as a traitor and arch-apostate for his having declared Mosaism superseded by the law of Christ. Of the Christian sacred books they held the Hebrew gospel of St. Matthew to be the only one given through Divine inspiration.

**Eb'lis**, or **Father of Devils**, in Arabian mythology, the ruler of the evil genii or fallen angels. Before his fall he was called Azazel or Hharis. When Adam was created, God commanded all the angels to worship him; but Eblis replied: "Me thou hast created of smokeless fire, and shall I reverence a creature made of dust?" God was very angry at this insolent answer, and turned the disobedient angel into a Sheytân (devil), and he became the father of devils. He is described as of enormous size, with a red-striped skin, a ring-pierced nose, long hair, large flapping ears and a very long tail. See **DEVIL**.

**Ebner-Eschenbach**, äb'nër êsh'en-bähr, **Baroness Marie von**, Austrian author: b. (COUNTESS DUBSKY) Castle Zdislavice, Moravia, 13 Sept. 1830. Beginning in 1860 as a playwright, her 'Mary Stuart in Scotland' (1860), and the tragedy 'Marie Roland,' with the one-act dramas 'Doctor Ritter,' 'Violets,' and 'The Disconsolate One,' were but moderately successful. Turning to fiction, 'The Princess of Banalia' (1872), a satiric tale, made little impression; but 'Two Countesses' (1885), a story of Austrian high society, met with striking favor. Her other writings include: 'Tales of Village and Castle'; 'The Child of the Parish' (1887); 'The Rival'; 'Aphorisms' (1880); and 'Parables, Stories and Poems' (1892).

**Eb'onite**, or **Vulcanite**, a name given by Goodyear for what is generally known as hard rubber. It is a vulcanite with a larger proportion of sulphur and certain added ingredients. The proportion of sulphur is from 30 to 60 per cent, and to this may be added certain amounts of shellac, gutta-percha, sulphates of zinc, antimony, or copper. It is used of many colors, as may be gathered from the above list of ingredients, and of hardness and consequent facility for taking polish. The compound, despite its name, may resemble horn, ivory, bone, wood, etc. See **VULCANITE**.

**Ebony**, various kinds of wood obtained from several species of *Diospyros*, a genus of trees of the natural order *Ebenaceæ*. The most valued and most frequently used varieties are very close-grained, hard and dark-colored, the best qualities black. This grade is obtained from *D. ebenus*, a native of the eastern tropics, especially India. It is a large tree from which logs containing a cylinder of the dark heart wood more than 18 inches in diameter are often obtained. The sap wood is less valued, being of

lighter color and less hard. The wood is especially valued for inlaying, cabinet work, musical instruments, etc. Various other names are given to certain varieties of ebony obtained from other regions, as calamander wood, cadoobergia wood, etc. Occasionally specimens of *D. virginiana*, popularly known throughout the southern United States as the common persimmon, furnish a fair grade of ebony. Several other trees, especially of the genus *Maba*, yield varieties of ebony, as do also a few trees of the order *Leguminosæ*. Bastard ebony is obtained from species of Jacaranda, Brazilian trees. Imitations of ebony are sometimes made by dyeing hard, close-grained woods so as to resemble the genuine ebony.

**Eboracum**, ē-bŏr'a-kŭm, the Latin name of York. Hence New York is styled in Latin works "Novum Eboracum."

**Ebro**, ā'brō (Lat. *Iberus*), a river in Spain, once the boundary between the territory of Rome and Carthage, has its source in the province of Santander, 10 miles west by north of Reynosa. Pursuing a southeast course of about 500 miles, it flows into the Mediterranean by two mouths. It is navigable for boats up to Tudela, about 180 miles from its mouth, but is obstructed by shoals and rapids, to avoid which a canal, about 100 miles long, has been constructed south of and nearly parallel to the river.

**Ebs'worth**, **Joseph**, English dramatist and musician: b. London 10 Oct. 1788; d. Edinburgh, 22 June 1868. He wrote, adapted, or translated many successful plays; among them 'The Rival Valets' (1825), a comedy drama, and 'The Crusaders' (1850-1), a drama. He was an adapter rather than a creator. His songs, learning, and versatility made him a distinguished figure in Edinburgh circles. He wrote also in collaboration with his wife, Mary Emma (Fairbrother).

**Ebullition**, ēb-il-lish'ŏn, the bubbling up or agitation which results from the action of heat on a liquid. The escape of vapor from water depends not merely upon the temperature, but upon the presence of gases and other bodies, upon the vessel, and a variety of circumstances, so that a strict definition is necessary. The usual statement is that ebullition is the conversion of a liquid into a vapor or gas having the same tension or elastic force as the air. This conversion takes place at different temperatures for different substances, but it is so constant for each substance that the fixity of the boiling-point of a fluid is regarded as a very good test of its purity. In determining what that point is, it is of course necessary to ascertain what the atmospheric pressure is, to see that it does not vary during the experiment, and to fix upon some standard pressure for comparison of results. The pressure is estimated by the barometer. It is possible to heat water 20° F. above its boiling point without ebullition. See **HEAT**.

**Eça de Queiroz**, José Maria, hō-sā' mā-rē'ā ā'sā-dā-kā-rōs, Portuguese novelist: b. Póvoa do Varzim 25 Nov. 1845; d. Neuilly, France, September 1900. At first a journalist, he traveled and was in the consular service in many parts of the world. He introduced the naturalistic school into Portugal. His powers of observation and description are extensive, and in his novels — 'The Crime of Father Amaro'

(1874, rewritten in 1880); 'The First Monk of St. Basil' (1877); 'A Relic' (1886) — he portrays in master strokes the failings of Portuguese society. His strange, half realistic, half fanciful story, 'The Relic,' weaves into a narrative of Oriental travel a dramatic representation of the Passion of Christ in the form of a dream. In collaboration with Ramalho-Ortigão he wrote the spirited tale of adventure, 'The Mystery of Cintra Street.'

**Écarté**, ā-kār-tā, from the French, meaning discard, a game at cards for two persons. The game is played with a piquet pack, that is 32 cards, the small cards, from 2 to 6, being excluded. For convenience of dealing, two packs are generally used. The players cut for the deal; the lowest card (in France the highest) deals. The dealer gives 5 cards to each player, 3 and 2 at a time, and turns up the 11th card as trump (French, *atout*). If the turn-up is a king he scores 1, and if a king turns up in the hand of either player the holder may score 1, but in each case this must be announced before the first trick by saying, "I mark king." The king is the highest card, the queen next, then knave, ace, 10, etc. Trump takes all other suits. In playing the non-dealer leads; the other player must follow suit, and take the trick if he can; if he cannot follow suit, he must play trump, if he holds one. The winner of the trick leads again till the 5 tricks are exhausted. Three tricks count 1 point, 5 tricks 2 points. Five points make a game. The player, according to the French game, must announce the suit he plays, and if he plays differently, can be compelled to play as he announces, or if he cannot, as his adversary pleases.

**Ecbatana**, ěk-bāt'a-na, the chief city or ancient metropolis of Media, built, according to Pliny, by Seleucus. It was the summer residence of the Persian and Median kings, and existed in great splendor at a very early period in the history of the world. There are no traces now remaining of the site of this celebrated city.

**Eccard, Johannes**, German composer: b. Mühlhausen, Thuringia, 1553; d. Berlin 1611. He became Kapellmeister to the Margrave of Brandenburg at Königsberg in 1589, and in 1608 became Kapellmeister in Berlin. He is noted as a composer of hymns and other church music.

**Ecce Homo**, ěk'sē hō'mō ("Behold the Man"), the rendering, in the Latin Vulgate, of the words with which Pilate presented Christ, in scarlet robe and crowned with thorns, to the populace. The figure of Christ in this scene is the subject of a celebrated painting by Correggio which is preserved in the National Gallery of Painting in London. Other great painters have chosen the same subject, among them Guido Reni, whose 'Ecce Homo' is in the Picture Gallery of Dresden.

**Eccentric**, or **Eccentric Circle**, in ancient astronomy, a circle whose centre was supposed to be displaced from the centre of motion. It was a makeshift to try to account for the motions of the planets before Kepler's discovery of their true motion in ellipses with the centre of attraction at one of the foci of the ellipse. Also, in mechanics, a term applied to contrivances for converting circular into reciprocating rectilinear motion, consisting of variously shaped disks attached to a revolving shaft.

**Eccentricity**, deviation from a centre; the state of a circle without reference to its circle; also applied to persons, as oddity, whimsicalness, etc.

**Ecchymosis**, ěk-ī-mō'sīs, a subcutaneous hemorrhage due either to bruising or some form of external injury, or occasionally the result of a peculiar blood disease hæmophilia. Ecchymoses usually result in varying grades of discoloration, and are best treated by means of hot water, locally applied.

**Ecclefechan**, ěk-l-fēh'ān, Scotland, village of Dumfriesshire, nearly a mile from a station on the main line of the Caledonian R.R., 20 miles northwest of Carlisle. Its interest is that it is the birth- and burial-place of Thomas Carlyle, and is unmistakably the "Entepfuhl" of his famous spiritual autobiography, 'Sartor Resartus.' The house in which he was born, 4 Dec. 1795, still stands, and in the west corner of the churchyard around the United Presbyterian Church, which represents the old Secession Church, he was laid, as he wished to be, beside his father and mother. Pop. 750.

**Eccles**, Robert Gibson, American chemist: b. Scotland 1 Jan. 1848. He came to the United States in 1862 and became chemist in the Bureau of Indian Affairs; and professor and dean in the Brooklyn College of Pharmacy. He has discovered calycanthic acid and the alkaloids calycanthine, glaucusine, etc., and devised the official method of assaying pepsin and investigated the effects of drugs on peptic digestion. He also exposed numerous fraudulent medicines, among them the Scotch oats essence. He has written more than 100 articles on philosophic and scientific subjects.

**Eccles**, England, a municipal borough in Lancashire, four miles from Manchester, of which it is a suburb. There are here numerous cotton-mills. Pop. 34,369.

**Ecclesfield**, England, a township in the West Riding of Yorkshire, six miles north of Sheffield. The chief manufacture is cutlery, then flax, linen, paper, and nails; while in the vicinity there are coal and iron mines. Pop. 26,000.

**Eccle'sia** ("convocation"), a popular assembly, especially that of Athens, where the people exercised full sovereignty, and at which every citizen of 20 years of age was entitled to vote. The people voted either by show of hands or occasionally by ballot, the latter method being by white and black pebbles. Beside the legislative powers of the assembly, it could make inquisition into the conduct of magistrates, and in turbulent and excited times exercised a power resembling that of impeachment, as in the cases of Demosthenes and Phocion. The assembly was sometimes suddenly broken up at the occurrence of an unfavorable omen, as thunder and lightning, sudden rain, or any unusual natural phenomenon. The Athenian ecclesia held originally 4, ultimately 40, ordinary meetings in the year. The term was also applied by the Septuagint translators to the Jewish commonwealth, and so was naturally adopted by New Testament writers to designate the Church.

**Eccle'sias'tes**, or **The Preacher** (Heb. *Kohaleth*, "assembler"), one of the didactic books of the Old Testament canon, professing to be the words of the preacher, the son of David,



king in Jerusalem. It contains allusions to the writer's riches, palaces, and parables, and its sententious style reminds one of the author of the Proverbs. Yet its diction is marked by Chaldaisms and linguistic usages which are thought not to have been introduced into the Hebrew language till about the period of the Babylonian captivity. The authorship of the Ecclesiastes has been attributed to Solomon, whose claims have often been challenged and always defended; and if it be not his, it must remain entirely uncertain, for no writer of the Babylonian period is known so nearly resembling him in wisdom and wealth of thought. The book consists of philosophical reflections upon human life, and while it affirms: "Vanity of vanities, all is vanity," it also comes to the conclusion of the whole matter in the words: "Fear God and keep his commandments, for this is the whole duty of man." Some entertain the opinion that its original form must have been a dialogue in which the sage carries on a discussion with a skeptic and a libertine. Yet it is more commonly regarded as the monologue of a Hebrew moralizing on life and searching for the highest good, scanning the perversities and follies of man, and at length, after a review of the evidence, declaring the verdict that obedience to God is the only real and substantial good.

**Ecclesiastical Commissioners, for England**, are a body corporate with a common seal, perpetual succession, and power to hold real estate, constituted by acts 6 and 7. Will. IV. chap. lxxvii., 3 and 4 Vict. chap. cxiii., and 13 and 14 Vict. chap. xciv. It consists of all the bishops of the Church of England, the deans of Canterbury, St. Paul's, and Westminster; the chief justices, 5 cabinet ministers, and other legal dignitaries, and 12 lay members appointed by the crown and the archbishop of Canterbury. This body has extensive powers in regard to the organization of churches, the distribution of episcopal duties, revenues, etc. The schemes adopted by the commission, on being laid before the king in council, approved of, and gazetted, acquire the force of acts of Parliament.

**Ecclesiastical Titles Act**, a law of the British Parliament, enacted in 1850 (14 and 15 Vict. chap. 60) to prohibit, under penalty, the assumption of ecclesiastical titles (for example: Archbishop of Westminster, Bishop of Clifton, Dean of Sheffield) by any persons not duly appointed to such stations according to the laws of the realm touching the Church establishment. There was already in the statute book a law of 10 Geo. IV., chap. 7, which provided that any person who should assume or use the name, style or title of archbishop of any existing ecclesiastical province, or bishop of any existing diocese, or dean of any existing deanery of the Established Church of Great Britain, and Ireland, the same not having due legal right to such name, etc., should for each violation of the act forfeit £100. But in the year 1850 Pope Pius IX., by apostolic brief, instituted an ecclesiastical province or archbishopric comprising all England and Wales, with Nicholas Wiseman (afterward cardinal) as archbishop, with the style and title of Archbishop of Westminster, and with 12 suffragan bishops presiding over dioceses named: Beverley, Birmingham, Clifton, Hexham, Liverpool, Newport and Menevia, Northampton, Nottingham, Plymouth, Salford, Shrewsbury and Southwark; none of

these towns was then the see of any bishop of the Established Church; and therefore the prohibition of the statute of George IV. did not apply. But the announcement of the setting up of these Roman Catholic dioceses provoked a fierce anti-popery agitation, and the prime minister, Lord John Russell, introduced in the Parliament a bill, which was speedily passed, extending the penalty of the act of George IV. to persons who should assume the titles archbishop, bishop or dean "in respect of any places within the United Kingdom." The new dignitaries ignored the act, assumed their titles, braved prosecution, and not one of them was ever called into court for contumacy. After the act had stood on the statute book as the law of the realm during 20 years it was amended by the act of 34 and 35 Vict., chap. 53. The penalty was dropped, but the so-called repealing act recited again the legal grounds for the penal enactment and declares that "no ecclesiastical title of honor or dignity derived from any see, province, diocese, or deanery recognized by law, or from any city, town, place or territory, within the realm can be validly created"; and that "no pre-eminence or coercive power can be conferred otherwise than under the authority of Her Majesty"; decisions of law that had never been impugned in England since the time of Henry VIII.

**Ecclesiology**, the science of the Church as an organized society, a branch of knowledge which deals with ecclesiastical antiquities, such as buildings, rites, vestments, etc.

**Ec'cleston, Samuel**, American Roman Catholic prelate: b. Kent County, Md., 27 June 1801; d. Georgetown, D. C., 21 April 1851. He was educated in St. Mary's College, Baltimore, and ordained to the priesthood of the Roman Catholic Church 1825. He subsequently served St. Mary's College as vice-president and president; became archbishop of Baltimore in 1834; and established the College of St. Charles in 1850. He was president of five provincial councils and inaugurated the movement which resulted in the laws for the transmission of church property from a bishop to his successor and for the excommunication of any Roman Catholic who, after being divorced by the State, should marry again.

**Ecdysis**, the process of casting the skin (see **MOLTING**). The term is used mainly in reference to the exuviation of the pupa of insects, and of the outer cuticle of lower invertebrates, as crabs.

**Ech'ard, or Eachard, Laurence**, English clergyman and historian: b. Barsham, Suffolk, 1670 (?); d. Lincoln 16 Aug. 1730. His 'History of England from the First Entrance of Julius Cæsar and the Romans to the End of the Reign of James the First' (1707) contains a wealth of information, including the particulars of Cromwell's interview with the Devil on the morning of the battle of Worcester. Other historical and scholarly works increased his reputation.

**Echegaray, José**, hō-sā' ā-chā'gā-rā'ē, Spanish dramatist: b. Madrid 1832. He is author of several treatises on mechanics and civil engineering, and was for a time minister of commerce and of public instruction. Since 1874, when the production of 'The Avenger's Bride' opened a new and brilliant life for the Spanish



stage, he has given himself wholly to the drama; producing in a few years 30 plays rich in imagination, dramatic force, and lyric talent, though with the true Spaniard's love of the horrible. Of his greatest pieces may be named: 'The Great Galeotto'; 'Madman or Saint'; 'Conflict Between Two Duties'; 'A Merry Life and a Sad Death.' See Zacher, 'Don José Echegaray' (1892).

**Echellen'sis, Abraham**, Maronite scholar: b. Ekhel in the Maronite country of Mount Lebanon; d. 1664. He was an alumnus of the College of the Maronite nation at Rome, and was called to the chair of Syriac and Arabic in the College of the Propaganda. From 1630 till 1642 he was engaged at Paris in making Arabic versions of books of Scripture for a Polyglot Bible; afterward, from 1652 till his death, he was employed in similar work under the auspices of the Congregation de Propaganda Fide at Rome. He made Latin translations of numerous works in Arabic.

**Echelon**, esh'elōn (Fr. "a ladder or stepping stone"), used in military language. A battalion, or regiment, marches *en échelon*, or *par échelon*, if the divisions of which it is composed do not march in one line, but on parallel lines. The divisions are not exactly behind each other, but each is to the right or left of the one preceding, so as to give the whole the appearance of a stairway. This order is used if the commander wishes to bring one part of a mass sooner into action and to reserve the other. If the divisions of the *échelon* are battalions, these are generally from 100 to 200 steps from each other. An *échelon* is said to be direct if its head maintains a position perpendicular to the original line, as in direct attack or retreat; it is said to be oblique when it deviates from the line, as in changing the order of formation.

**Echeneis**, ek-ē-nē'is, a genus or family of fishes. See REMORA.

**Echenique, José Rufino**, hō-sā' roo-fē'nō ā-chā-nē'kā, Spanish-American soldier and statesman: b. Puno, Peru, 1808; d. Arequipa 18 Oct. 1879. He joined the Patriotic party as a boy, rose to the rank of colonel and induced the revolted troops of Gamarra and Bermudez to return to their allegiance in 1833; at the battle of Yungay 1839, he fought on the side of Vera Cruz, in 1845 was a member of Castillas council of state, and in 1851 was elected president of Peru. In 1854 he was charged with financial irregularities and Domingo Fias led a revolt against him which terminated in the battle of Saraija 1854. He was defeated in a second revolt, at the bridge of Iscuchacha, 2 Aug. 1854, retired to Lima, was again defeated at the battle of La Palma, 5 Jan. 1855, and driven into exile. He was permitted to return as a private citizen and was even a presidential candidate in 1872, but spent the last years of his life in retirement.

**Echeverria, ā-chā-vā-rē'ā, Estaben**, Argentine poet: b. Buenos Ayres, Argentina, 1809; d. Montevideo, Uruguay, 1851. He was educated in France and was banished from Argentina by Rosas. Among his works, which are in great repute among his countrymen are: 'Consuelos' (1834); 'Rimas'; 'Cautiva' (1837), containing delightful descriptions of the pampas; 'Guitarra' (1842); and 'La Insurreccion del Sud' (1849).

**Echid'na**, or **Spiny Ant-eater**, an Australian monotreme animal of the family *Echidnidae*, or *Tachyglossidae*, closely related to the duckbill, but very different in outward appearance. Echidnas are spiny, porcupine-like creatures, 12 to 18 inches long, with broad bodies, stout legs terminating in large, strong claws well suited for digging, and a small head, ending in a slender snout. The mouth is toothless but the palate bears a number of recurved spines, which answer the purpose of teeth; the tongue is extensile and glutinous. The animal resembles the hedgehog in that it curls up when in danger, presenting its long spines, and protecting by this method its naked belly. It lives in burrows and feeds chiefly on the juicy larvæ of ants, into whose hill its digs with its great claws. Like the duckbill, the echidna lays eggs, but little is known as to their hatching. The creatures are docile and are easily tamed, becoming playful in captivity and exhibiting considerable intelligence. They are nocturnal in habits, and spend periods of drought curled up in their burrows. The common echidna (*E. aculeata*) is found in Tasmania and New Guinea. It is so variable in color and size that it is sometimes held to form two species, differentiated by their general size and habitat. The "nodiak" of Papua (*Proechinida* or *Acanthoglossus bruijnii*) is a kindred animal hunted by the natives for food.

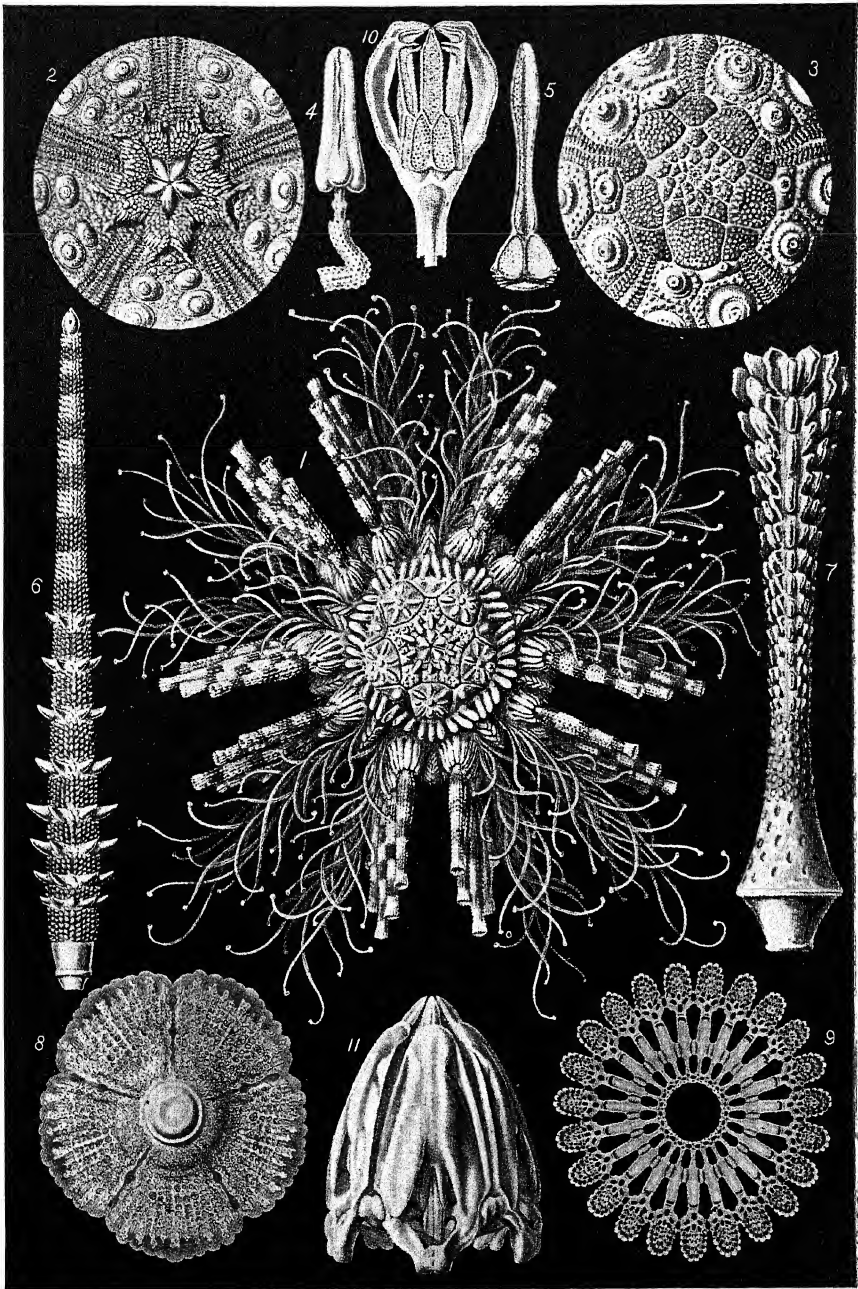
**Echinades**, ẽk'n'a-dẽz (modern KURZOLARI), a group of islands at the entrance of the Gulf of Corinth, and now in part united to the mainland by deposits brought down by the Achelous River. It was near these islands that the Battle of Lepanto was fought in 1571. See LEPANTO, BATTLE OF.

**Echinocactus**, ẽ-kĩ-nõ-kak'tũs, a genus of plants of the natural order *Cactaceæ*, characterized by globular or shortly cylindrical forms with prominent ribs and strong spines. Over 200 species, mostly Mexican, have been described; about 40 species are natives of the southwestern portion of the United States, extending as far north as southern Utah, Colorado, and Nevada. The flowers, which are highly colored, mainly in shades of yellow and red, are borne just above the areas producing the youngest spines and are succeeded by dry or succulent fruits of no economic use. The plants are raised with comparative ease from seeds, given abundant light, but not direct sunlight, which tends to dry the little seedlings, supplied moderately with water before the soil has a chance to bake, and kept in a temperature of about 60 degrees. When about two inches in diameter they may occupy single pots as specimens. About 50 species are cultivated in American greenhouses, and are among the favorite plants of their order.

**Echinococcus**, ẽ-kĩ-nõ-kõk'ũs, a small tapeworm (*Tania echinococcus*), to which is due the disease called "hydatids" in man and in various animals. See TAPEWORM.

**Echinoc'ereus**, a genus of plants of the natural order *Cactaceæ*, with generally low, thickly clustered stems, mostly short funnel-formed, brilliantly colored flowers of various tints, and globose or ellipsoidal fruits which are spiny until they reach maturity. By some botanists the genus is united with *Cereus*, from which it is distinguished mainly by technical characters that are present in some species of

# ECHINODERMS.



- <sup>1</sup> *Cidaris tribuloides*.    <sup>2, 3</sup> *Cidaris baculosa*.    <sup>4</sup> *Dorocidaris papillata*.    <sup>5</sup> *Strongylocentrus nudus*.  
<sup>6</sup> *Phyllacanthus annulifera*.    <sup>7</sup> *Phyllacanthus baculosa*.    <sup>8</sup> *Psammechinus miliaris*.  
<sup>9</sup> *Centrostephanus longispinus*.    <sup>10, 11</sup> *Sphaerechinus esculentus*.



## ECHINODERMATA — ECHINOIDEA

each group. About 25 pieces are general favorites in American greenhouses. They are cultivated in about the same way as *Echinocactus* and *Cereus* (qq.v.).

**Echinodermata**, ĕ-kī-nō-dēr-ma'-ta, or **Echinoderma**, one of the most distinct phyla of the animal kingdom, embracing the crinoids, sea cucumbers, sea urchins, and starfishes. On account of a predominating radial symmetry Cuvier united them with the *Cœlenterata* in his type *Radiata*. Leuckart was the first to clearly perceive that only a superficial resemblance exists between the members of these two great groups and to him is due the elevation of the *Echinodermata* to the importance of a distinct phylum. The skin is always more or less indurated by the deposition of calcium carbonate in the form of variously shaped spicules, spines, disks or plates, either isolated or united to form a reticulum or a continuous test. There is a principal axis around which most of the organs of the body are repeated five times in a radial manner. While this pentamerism is generally predominant, certain organs (madreporic plate, stone canal, "heart") occur in but one radial axis which, therefore, lies in a median plane to which all other organs are bilaterally related. Of the repeated organs the digestive glands, radial canals, nerves, various vessels, the eye-spots, and some others, are radial, the genital organs (single in *Holothuroidea*) and polian vesicles interradial in position. The partial suppression of one ray or two rays, and among the starfishes a multiplication of rays, may take place; furthermore, in some *Echinoidea* and *Holothuroidea* certain of the organs or rays may shift so extensively with regard to the principal axis and the median plane that the original pentamerism becomes obscured. There is a well-developed coelom or body cavity and a closely connected "blood" or pseudohæmal system which consists of an axial organ or "heart," a circumoesophageal ring, radial vessels, and a more or less extensive system of lacunæ. In addition to the blood vascular system there is a very characteristic water-vascular system which, when typically developed, consists of a median madreporic or sieve plate and stone canal, a circumoesophageal canal bearing polian vesicles and other diverticula, and giving rise to radial canals which in turn bear rows of ampullæ and tube feet. The latter are the chief organs of locomotion, and the most important function of the water-vascular system is to provide for their distention by means of the water which is strained through the madreporic plate and enters the stone canal. In some cases the tube feet assume an exclusively respiratory function. With few exceptions the sexes are separate and, following fertilization in the water external to the body, a free swimming larval form develops, except in a few cases, from the egg. This is always bilaterally symmetrical, has a curved alimentary canal with mouth and anus, and a more or less complicated ciliated tract of cilia or separate circles of cilia, and a pair of coelomic pouches. Older larvae often develop irregular processes and a larval skeleton. The larvae of the several classes differ considerably in structural details and have been named auricularia, bipinnaria, pluteus, etc. The Echinodermata are exclusively marine. Four classes may be recognized, as follows:

*Crinoidea*, usually fixed to the sea bottom by the aboral surface; the mouth uppermost and the viscera all contained in the central disk or theca. When arms are present they are solid and usually branched. Stone lilies or crinoids. Here belong also the extinct blastids and cystids which are often regarded as forming separate classes.

*Stelleroidea*, never fixed to the sea bottom; the mouth or oral surface always in contact with the surface over which they are moving; tube feet confined to the oral surface; form stellate. There are two quite distinct sub-classes, the *Ophiuroidea*, or brittle stars, serpent stars, and basket stars; and the *Asteroidea*, or true starfish.

*Echinoidea*, never fixed to the sea bottom; ambulacral areas with the tube feet extending more or less over the aboral surface; form compact, more or less discoid or spheroidal. Sub-classes, *Regularia*, or regular sea-urchins; and *Irregularia*, or irregular sea-urchins.

*Holothuroidea*, never permanently fixed to the sea bottom; water-vascular system with a circle of oral tentacles; more or less elongated along the principal axis to a cucumber or wormlike form; skeleton in the form of separate plates or sometimes totally wanting. See CUCUMBERS.

For further information consult: Lankester, 'Treatise on Zoology,' (Part III.), and articles on the several classes.

**Echinoidea**, ĕk-ī-noi'de-a, or **Sea Urchins**, a class of *Echinodermata* with a more or less spheroidal or discoidal body enclosed in a continuous test or shell composed of polygonal pieces of various shapes accurately fitted together and arranged in radial rows. Alternating ambulacral and interambulacral areas, usually repeated five times, may be recognized. The former exhibit rows of perforations for the tube feet, generally reaching to the aboral pole. The skeletal plates support movable spines which sometimes attain a great size and are used in defense and to a certain degree in locomotion. In addition, the integument bears the remarkable structures known as pedicellaria, which are three-jawed pincers borne on movable stalks, which by continually snapping and bending carry away particles of faecal matter and secure cleanliness. The beginning of the digestive canal is frequently provided with a complicated masticatory apparatus known as Aristotle's lantern, and the canal itself is tubular and looped, usually not pouched. The gonads are interradial with outlets to the exterior near the aboral pole. Development may be direct or through the larval form called pluteus, which is provided in its later stages with long processes supported by movable spicules. The number of known Echinoidea is very great, many of them being fossil. There are two sub-orders:—*Regularia*, form regular, spheroid; mouth and anus at opposite poles of the central axis, and the latter usually surrounded by small skeletal plates; in only a few cases are external gills present. Here belongs the common sea-urchin (q.v.). *Irregularia*, form markedly bilateral; anus always displaced from the apical pole into the posterior inter-radius and the mouth frequently in the opposite direction, in which case the form is sometimes heart-shaped. Examples are the sand-dollar and heart urchin (qq.v.).

**Echinorhynchus**, ě-kī-nō-rīng'kūs, a parasite worm. See **ROUNDWORMS**.

**Echo**, from the Greek, meaning "sound," noise; a sound repeated by reflection, or a sound heard again at its source. The waves of sound on meeting the surface are turned back in their course according to the same laws that hold for reflection of light. Even clouds are capable of producing echoes, as is observed at sea when a gun is fired off under a dense cloud. Echoes from the clouds also, in all likelihood, play an important part in the long rolling of thunder. In order that the echo may return to the place from which the sound proceeds the reflection must be direct, and not at an angle to the line of transmission, otherwise the echo may be heard by others but not by the transmitter of the sound. This may be effected either by a reflecting surface at right angles to the line of transmission, or by several reflecting surfaces which end in bringing the sound back to the point of issue. To make a distinct echo the reflected sound must be concentrated rather than diffused. To this result a degree of concavity in the reflecting body is conducive. If the sound is repeated several times, which is the case when it strikes against objects at different distances, many echoes are heard. The reflecting surface must be at a certain distance, in order that the echo may come to the ear after the sound, and be distinctly separated from it. Sound travels about 1,100 feet in a second; consequently, an observer standing at half that distance from the reflecting object would hear the echo a second later than the sound. Such an echo would repeat as many words and syllables as could be heard in a second. This is called a *polysyllabic* echo. If the distance is less, the echo repeats fewer syllables; if only one is repeated, then the echo is *monosyllabic*. The most practised ear cannot distinguish in a second more than from 9 to 12 successive sounds, so that a distance of not less than 60 feet is needed to enable a common ear to distinguish between the echo and the original sounds. Echoes at least distances, as from the walls of churches and public halls, are liable to mix with and destroy the distinctness of the original sound.

**Echo**, in classical mythology, a nymph (one of the Oreads), who, according to fable, was changed by Hera (Juno) into a rock, because her loquacity prevented Hera from listening to the conversation of Zeus with the nymphs. The use of her voice, however, was left her so far as to be able to repeat the last word which she heard from others. Another account is that Echo fell in love with Narcissus, and because he did not reciprocate her affection she pined away until nothing was left but her voice.

**Echo Cañon**, a gorge in northern Utah, not far from Salt Lake, through which the Union P. R. R. passes. The high almost vertical walls of the cañon have fantastic carvings made by the elements, principally water. The peculiar echo heard within the gorge has given it its name.

**Echolalia**, ěk-ō-lā'li-a, a peculiar form of verbal repetition which occurs in certain nervous, hysterical, and insane people. It consists in the ceaseless repetition of words that rhyme,

or apparently rhyme, or the continued utterance of some definite sentence or parts of a sentence. A like symptom termed *verbigeration* is frequently found in terminal dementias and allied mental states, and is to be distinguished from *echolalia*, which it closely resembles, by the repetition of meaningless and disconnected phrases. *Echolalia* is seen to best advantage in hysteria and in a peculiar type of mental disease known as *catatonia* (q.v.).

**Echter**, ěh'tēr, Michael, German painter: b. Munich 5 March 1812; d. there 4 Feb. 1879. He studied at the Munich Academy, as a pupil of Hess, Zimmermann and Olivier. He assisted Kaulbach in work on the mural paintings in the Berlin Museum, painted the 'Battle of Lechfeld' for the Maximilianeum; the 'Betrothal of Frederick Barbarossa with Beatrice of Burgundy' and 'The Burial of Walther von der Vogelweide' for the National Museum in Munich; and 30 scenes from the 'Nibelungenlied' for the royal residence. He was appointed professor in the School of Industrial Arts, and was a member of the Munich Academy.

**Echtler**, ěht'lér, Adolf, German painter: b. Dantzig, Prussia, 1843. He studied at the Venice Academy under Karl Blaas, and at the Munich Academy, and took the gold medal at Berlin 1875. Among his works are: 'A Difficult Problem'; 'Peaceful Company'; 'Honi Soit qui mal y pense' (1877); 'Souvenir of Italy'; 'Those whom I have always loved' (1879); 'The Kiss' (1880); 'Neapolitans in Normandy'; 'In the Morning' (1881); 'Repentant Sinners' (1882); 'Ruin of a Family'; 'All is Vain'; 'Souvenir of Venice' (1884); 'Five Orphans' (1885).

**Echuca**, ě-choo'ka, Australia, town in the colony of Victoria, on a peninsula at the junction of the Campaspe with the Murray River. It is opposite Noama, in New South Wales. It has a trade, partly by the river, in timber, wool, and wine, and the vine is cultivated in the neighborhood. Pop. about 5,000.

**Ecija**, ā'thē-hā (Rom. ASTIGI; AGUSTA FIRMA), Spain, a town in the province of Seville, on the Genil, 42 miles northeast of Seville. It is of very ancient origin, and according to tradition was visited by the apostle Paul. At a very early period it became an episcopal see, and its importance under the Romans is attested by many ancient remains. The climate is so hot that Ecija is often called the "Oven of Andalusia." Pop. in 1887 23,615.

**Eck (Eccius)**, Johann Maier von, a Catholic theologian, life-long adversary of Luther: b. Eck, Suabia, 13 Nov. 1486; d. Ingolstadt 1543. His father, a peasant named Maier, assumed the name Maier von Eck or Maier of Eck, after becoming bailiff of his village. Johann, at the age of 11 years, entered the University of Heidelberg whence he passed to the University of Tübingen and there at the age of 14 years took the degree of master of arts. He now successively at Tübingen, Cologne, and Freiburg universities studied divinity, jurisprudence, and mathematics, and at the same time was instructor in philosophy. He was appointed professor of theology in the University of Ingolstadt (1510). While on his travels in Italy (1515) he took part in a public disputation in

the University of Bologna and won high distinction; in 1516 on a similar occasion at Vienna he had a like success. In 1518 he published a pamphlet, 'Obelisci,' in defense of the Catholic doctrines attacked in Luther's celebrated 'Theses' of 31 Oct. 1517. Eck was now chancellor of the University of Ingolstadt and Luther put forward Carlstadt as a defender of the 'Theses'; Carlstadt not only replied to Eck in print, but challenged him to a public disputation. Eck accepted the challenge, and the disputation was held at Leipsic, with Eck as the champion of Catholicism against both Carlstadt and Luther. The disputation was commenced 27 June 1519, and lasted till 15 July. Upward of a year previously Luther in a letter to one of his friends credited Eck with eminent scholarship and great natural gifts, but after the disputation he was for Luther "a pitiful theologian" and "a miserable sophist." The numerous audience and the townsmen with unanimity awarded the crown of victory to Eck, and Luther in a private letter to his intimate friend Spalatinus, confesses defeat. Eck, stimulated by his success, devoted himself thereafter wholly to working for the overthrow of his adversaries. He procured from the universities of Cologne and Louvain a condemnation of Luther's writings and was honored at Rome with the commission to publish in Germany Pope Leo's bull *Exsurge Domine* against Luther. But he was received with manifestations of popular enmity almost everywhere; even at Leipsic the bull was solemnly committed to the flames by the students and the populace. On several notable occasions afterward—at the diet of Augsburg (1530), the conferences at Worms (1540) and those at Ratisbon (1541), he was again a principal champion of Catholicism. Some of his works are a German translation of the Old Testament, and a revision of Luther's translation of the New Testament. His pamphlets and books against the doctrines of Luther are included in 'Operum Johannis Eccii contra Lutherum.'

**Eckels, James Herron**, American financier: b. Princeton, Ill., 22 Nov. 1858. He was graduated at the Albany, N. Y., Law School 1880, and practised law at Ottawa, Ill., 1881-93. From 1893 till 1897 he was United States comptroller of currency. He is a Gold Standard Democrat, and president of the Commercial National Bank of Chicago.

**Eckermann, Johann Peter**, yō'hān pā'tēr ēk'ērmā, German poet: b. Winsen, Hanover, 21 Sept. 1792; d. Weimar 3 Dec. 1854. He has a permanent place in literature through his record of 'Conversations with Goethe in the Last Years of his Life' (1823-32); which has been translated into nearly all the languages of Europe, even Turkish. He edited the 40-volume edition of Goethe's works (1839-40).

**Eckert, Thomas Thompson**, American telegrapher: b. St. Clairsville, Ohio, 23 April 1825. In 1852-9 he was superintendent of the telegraph line between Pittsburg and Chicago; in 1859-61 superintendent of a gold-mining company in North Carolina; and in the latter year was appointed superintendent of the military telegraph department of the Potomac, with the rank of captain. Subsequently he was general superintendent of the military telegraph of the army, and was brevetted brigadier-general of volunteers for his services. In 1864-6 he

was assistant secretary of war; in 1866-75 general superintendent of the eastern division of the Western Union Telegraph Company; in 1875-81 president of the American Union Telegraph Company, and in 1892 became president and general manager of the Western Union Telegraph Company. He retired in 1902.

**Eckford, Henry**, American naval architect: b. Irvine, Scotland, 12 March 1775; d. Constantinople 12 Nov. 1832. He became a ship-builder in New York, in 1796; designed and constructed a fleet of war vessels for the United States government in 1812-14; built the Robert Fulton, which made the first voyage by steam to New Orleans and Havana; became naval constructor at the Brooklyn navy yard in 1820; and built several war vessels for European and South American governments.

**Eckhart, ěk'hārt, Johannes** ("MEISTER ECKHART"), the first of the German mystics in order of time and among the foremost in rank; the probable place of his birth is Cologne, and the year 1260 or a little earlier; d. 1329. He studied philosophy and theology in the University of Paris and joined the order of the Preaching Friars, or Dominicans, in which he was promoted to offices of high responsibility, for example, that of vicar-general of the Dominicans for Bohemia, provincial of the order in Saxony. In these places he effected many reforms in the houses of the order and was in high estimation as a preacher notwithstanding the abstruseness of his mystical speculations. Toward the end of his life this dissemination of his mystical views touching the nature of God and the relations between Deity and the human soul brought him under suspicion of being in sympathy with the Beghards, the Brethren of the Free Spirit, the Apostolic Brethren, and other fanatics, and 1327 he was cited before the court of inquisition at Cologne to make answer to charges of heretical teaching based on passages in his sermons. There he defended the inculcated propositions as entirely orthodox, but expressed his readiness to repudiate them if in the judgment of the head of the Church they were in conflict with the Church's creeds. In 1329 the decision arrived from Rome: 28 propositions contained in his sermons were condemned as heretical and Eckhart was ordered to recant; but he was now dead.

Whether these 28 propositions were or were not formally heretical, contradictory of the express teachings of the Church, they certainly contain doctrines that never have been put forth in any of the Church's formularies. However extravagant, they might have been tolerated or ignored, had they been entertained or discussed merely in the schools of theology and philosophy; but proclaimed from the pulpit and addressed to the common people, some of them ignorant, they were incitations to rebellion against all Church authority in teaching. His doctrine concerning the Godhead is plainly pantheistic-agnostic. For him there is no real being but God. God is the unknown and the unknowable. We cannot validly affirm anything of the Godhead; to predicate anything of Deity is to limit infinity. Yet though God is unknown and unknowable, and though we cannot predicate anything of him, still we can know the true God, the personal God, the Father; in this personal God, the Godhead it-



self. The triune God, Father, Son and Spirit, is evolved from the Godhead. And the Father comes to know himself in the Son; the return of the Son into the Father is the Spirit. In begetting the Son—who is coeternal with the Father—the Father brings into existence the universal world of things. As all things have sprung from the Father, so all things return to him. In the consummate union of man with God man is one with God; its will is God's will, its acts God's acts. Therefore it cannot sin. Having gone to such lengths of mystic speculation it is highly improbable that Master Eckhart could have recanted sincerely; but refusal to recant would have cost him his life or at least, his liberty. It was well for his fame that he died before he would have to make the election. His death occurred a little while before the arrival of the Pope's condemnation of his doctrines.

**Eckhel**, ěk'ĕl, **Joseph Hilary**, Austrian numismatist: b. Enzersfeld, Austria, 1737; d. 1798. After becoming a member of the society of St. Ignatius he was appointed keeper of the imperial cabinet of medals and professor of archaeology at Vienna. Eckhel may be regarded as the founder of the science of numismatics, the principles of which are elaborately developed in his treatise, *'Doctrina Nummorum Veterum'* (1792-8). He also published catalogues of the ancient coins and gems in the imperial cabinet, and other learned treatises.

**Eckstein**, ěk'stĕn, **Ernst**, German humorist, poet, and novelist: b. Giessen 6 Feb. 1845. From the university he went to Paris, and there completed his comic epos *'Check to the Queen'* (1870), and wrote *'Paris Silhouettes'* (1873), the grotesque night-piece *'The Varzin Ghosts,'* and the *'Mute of Seville.'* Later he wrote the stories: *'Margherita,'* *'At the Tomb of Cestius,'* *'The Mosque at Cordova.'* He was editor of a literary and critical journal, *'Hall of Poets,'* and of a humorous weekly, *'The Wag,'* at Leipzig for some years, and in 1885 settled in Dresden. He is a very prolific and inventive writer, and a master of technique. Besides a multitude of brilliant humorous sketches, he has written many stories of ancient classic life, as *'The Claudii,'* *'Aphrodite, a Story of Ancient Hellas,'* *'Decius the Flute-player: a Merry Story of a Musician in Ancient Rome.'*

**Eck'storm**, Fannie Hardy, American author: b. Brewer, Maine, 18 June 1865. She was graduated at Smith College 1888, and was married to Rev. J. A. Eckstorm 1893. She has published *'The Bird Book'* (1901); *'The Woodpeckers'* (1901).

**Eclampsia**. See PUERPERAL ECLAMPSIA.

**Eclampsia Infantum**. See INFANTILE CONVULSIONS.

**Eclectic** (from the Gr. *εκλεκτικός*, select), selecting, choosing; relating to the Eclectics, certain philosophers of antiquity, who, without attaching themselves to any particular system, or forming one of their own, professed to select from the various existing systems what they believed to be true, and thus to construct a new and complete whole. The name originated with

the Alexandrian philosophers, or Neo-Platonists, who professed to gather and unite into one body whatever was true in all the systems of philosophy. The chief representatives of this school are Plotinus, Porphyry, Iamblichus, Proclus, and Clemens Alexandrinus. Modern eclecticism is considered to have taken its rise in the 17th century with Bacon and Descartes; but in the 19th century it received a fresh impetus through the labors of the German philosopher Hegel, and the term eclectic has come to be specially applied to a number of French philosophers who differ considerably from one another. The earliest were Royer-Collard and Maine de Biran; but the name is more appropriately given to the school of which Victor Cousin, Théodore Jouffroy, Damiron, St. Hilaire, Rémusat, Garner, and Ravaisson were the most distinguished members. The views of Cousin varied considerably at different periods of his life, and he not only adopted freely what pleased him in the doctrines of Laromiguière, Royer-Collard, and Maine de Biran, of Kant, Schelling, and Hegel, and of the ancient philosophers, but he expressly maintained that the eclectic is the only method now open to the philosopher, whose function thus resolves itself into critical selection and nothing more.

**Eclecticism**, a term applied at the present day, to the principles and practice of an ancient as well as a modern school of medicine. It is derived from a Greek word meaning "to select" and was well applied to the ancient school. In the modern school, however, "selecting the best," has played but a minor part in comparison to doctrines originating within the school, such as the theory of specific medication, a doctrine distinctly its own. In the early centuries a number of distinct schools of medicine arose. Among these were the dogmatic, methodic, pneumatic, and empiric. From these arose the Eclectic, or episynthetic. The physicians of this sect wished it implied that they had made a rational selection of all that was best in the other medical schools. The practice of Areteus, who, though not the founder, did the most to consolidate its doctrines, was simple, rational, and by far the most judicious of the ancients up to his time.

Modern Eclecticism, in the United States, embodies the principles and practice of the Eclectic, or American school of medicine founded by Dr. Wooster Beach in New York city, in 1825. It was first known as the American Reformed school. While it employs most largely remedies of vegetable origin it must not be confounded with Thomsonianism, a popular form of botanic practice taught and practiced by Dr. Samuel Thomson in New England in the early part of the nineteenth century, the peculiar theories and extreme measures of which were never adopted by the Eclectics. Among the most bitter antagonists of the latter were the followers of Thomson. As students and developers of indigenous materia medica the American Eclectic practitioners have been the most assiduous in all history, and in this field they have won the admiration of the rival schools of medicine. The majority of Eclectics of the present day adhere to the doctrine of specific medication, the basic theory of the

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modern school, promulgated by Dr. John Milton Scudder, of Cincinnati, Ohio, in 1869. The Eclectic or American school of medicine of today is distinctively a school of specific therapeutics. (See MEDICINE, ECLECTIC.)

H. W. FELTER, M. D.

**Eclipse** (Gr. *ἔκλειψις*, from *ἐκλείπειν*, to forsake the accustomed place, to fail to appear), an obscuration of the light of a heavenly body by another, effected either, directly, by its intervention between the body and the observer, or, indirectly, by its interception of the source of light which illumines the body. The earth, by means of its shadow, may indirectly cause an eclipse of the moon. Similarly, eclipses of the Jovian satellites are caused by immersion in the shadow of Jupiter, and for the system of Saturn a more complicated result arises on account of its ring. When the shadow of a satellite falls upon either of these planets it is called a transit of the shadow. Eclipses are not observable in the other planetary systems, since, in the case of Mars, the satellites disappear in the light of the planet, and with the more distant planets the shadow cone extends too slight a distance beyond the disk. Again, our moon can by its direct interposition between the sun and the earth produce eclipses of the sun. Similar occurrences are observed in the Jovian and Saturnian systems and are then called transits of the satellites, but in the outer planets have not as yet been observed. The moon may interpose itself between the stars or planets and occult them (see OCCULTATION), and the other bodies of the solar system may act similarly. The eclipses of the sun by the inner planets are designated transits (see TRANSITS), but the obscuration of satellites and stars by the disks of planets are called occultations. The most important of these phenomena are the eclipses of the sun and moon.

**Eclipses of the Moon.**—A lunar eclipse is caused by the interposition of the earth between the sun and the moon and the moon's consequent immersion in the shadow of the earth. This can occur only when the moon is in opposition to the sun on the heavens, at the time of full moon, and both sun and moon are near the moon's nodes, i. e. the points where her orbit crosses the plane of the ecliptic. Let the sun, earth and moon be regarded as spherical bodies and their centres ranged in a right line. Then the sun will project beyond the earth a conical shadow called the *umbra*, in which the moon is centrally immersed. The surface of this cone will be described by a line tangent to the same side of both sun and earth and moving about the line joining their centres. The apex of the shadow cone, or of the *umbra*, is on the average about 157,000 miles beyond the earth's centre, and the diameter of the umbral cone at the point where the moon crosses it on the average about two and two thirds the diameter of the moon, with a variation from scarcely twice to more than three times the lunar diameter. If, again, two lines tangent on opposite sides of the sun, and crossing between sun and earth, move about the line joining the centres of these bodies, these lines will describe the surface of two cones of which the one extending beyond the earth is that of the *penumbra*. Unless the moon be near one of her nodes at the time of full moon, she will not strike the shadow, but pass

below or above it. If the sun is less than 4 days from a node of the moon's orbit, an eclipse must occur; if more than 14 days from a lunar node, an eclipse is impossible. These are called the lunar eclipse limits. Since the moon must be quite near her node to produce a lunar eclipse, it may happen that an entire year may elapse without an eclipse of the moon. The lunar eclipses may be either partial or total according as the moon is immersed either partly or entirely in the earth's shadow cone. The phenomena of a total lunar eclipse are of a simple character. The immersion of the moon in the penumbra can be observed only with difficulty. The edge of the shadow itself presents a hazy outline when seen in a telescope, and the times of contact cannot be observed with accuracy. When completely within the earth's shadow, the moon is usually still plainly visible in a dull copper-colored illumination which is produced by the sunlight shining through the earth's atmosphere, suffering absorption of its higher tints, and experiencing deflection into the shadow cone through refraction. Lunar eclipses have, however, occurred in which the moon was almost entirely invisible during the total phase. The obscuration of the earth's atmosphere by clouds accounts for these dark eclipses. Specially bright lunar eclipses have, on the other hand, been attributed to terrestrial auroras occurring at the same time. The most interesting physical observations effected during its eclipse concern the luminous and heat radiations of the moon. Valuable astronomical observations then possible are the determinations of the times of occultation of faint stars whence precise values of lunar position, diameter, and parallax may be derived.

**Eclipses of the Sun.**—Solar eclipses can occur only at the time of new moon. If the sun be more than 19 days from a node of the moon's orbit, an eclipse is impossible, if less than 10 days, a central solar eclipse is inevitable. These are the solar eclipse limits. The sun causes the moon to project toward the earth at new moon, umbral and penumbral shadow cones differing in the main only in size from those which the earth projects toward and beyond the moon at full moon. The method of conceiving the generation of the shadow cones of the umbra and of the penumbra are the same in solar as in lunar eclipses if the moon be substituted for the earth. The shadow cone of the moon may strike the earth's surface, but on the average does not. Two distinct cases may arise. First, the axis of the shadow cone strikes the earth's surface, and upon it the right line joining the centres of the solar and lunar disks, traces the curve of centrality. Here three cases result: (1) The apex of the shadow cone reaches the earth's surface and a central *total* eclipse occurs. (2) The apex of the shadow cone does not reach the earth's surface and there occurs a central *annular* eclipse. (3) The apex of the shadow cone reaches the earth's surface only at a middle stretch of the curve of centrality and there occurs a central *annular-total* eclipse. Secondly, the axis of the shadow cone does not strike the earth's surface but the earth still enters the shadow cone, or shadow cone produced, and there occur total, annular, and annular-total eclipses, all of which are of a non-central character. The

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path of a total eclipse on the earth cannot exceed 167 miles in width and is often not over 135 miles, but it may traverse a length from west to east of several thousand miles. An annular eclipse has also a "path of the annulus" in which the annular phase is visible. Outside of both of these paths the sun is only partially eclipsed. The least number of eclipses, solar and lunar, which can occur in a year, is two, and these must be central eclipses of the sun, while the maximum number occurring is seven, two of the moon and five of the sun. The average number hardly exceeds four. The minimum number of two eclipses is determined by the fact that the sun in its annual path crosses both nodes of the moon's orbit. The retrograde motion of the moon's nodes around the ecliptic continually changes the two eclipse seasons of the year, and is also responsible for the famous cycle of eclipses discovered and used long before its physical explanation was possible. A simple record of the date and character of the eclipses revealed to early astronomers the fact that after a period of about 18 years, eclipses again recur in the same order and kind whether solar, lunar, total, or partial. This cycle, called the saros, is one of 223 lunar months, each of a little more than 29.5 days, and is precisely 6,585.32 days in length. Depending on the number of leap years, 5, or 4 intervening, this is equal to 18 years, 10.32 days, or 11.32 days. At the end of the saros, the relative positions of the sun, moon, and node of the moon's orbit are nearly the same as at the beginning, and other favoring factors of the motions of the sun and moon also recur, as Newcomb first pointed out, to nearly original values. The excess of one third of a day in the cycle causes the eclipse to be thrown about eight hours of longitude farther west on the earth's surface. Hence only after three cycles does the eclipse again recur in approximately the same longitude. If the intervening leap years be regarded, the application of the saros to various series of solar eclipses of the following table may readily be made.

Ancient eclipses are chiefly of value in historical and chronological investigation (see TIME). The records of the supposed eclipses of the ancient historians are usually very uncertain as to place, time, and character of the occurrence, and hence have proved of questionable value to the astronomer. The precise circumstances of an eclipse occurring centuries ago can readily be computed from the modern tables, but the comparison with the vague historical references has apparently contributed but little to science. Ginzel has, in his 'Special Canon of Eclipses,' collected a splendid array of ancient eclipse literature, and this has been used to derive corrections to the lunar tables, but Newcomb seems justly to question the validity of the results. The eclipses observed by the older astronomers and carefully recorded are of great value. And in later times the description of eclipses has been so accurately interwoven with even historical accounts as to furnish unquestionable data for chronology. The terror and apprehensive uncertainty associated with an eclipse in ancient times has given place to a lofty appreciation of the grand occasion, and to a careful and inspiring scientific study of the phenomena.

The annexed table of total solar eclipses

occurring during the present century has been prepared with the aid of the memoirs of Oppolzer and Mahler, and is a complete list of all the eclipses of the century having a total phase, however brief. The first column gives the date for the point on the earth where at noon the eclipse is central. The second column gives the Greenwich civil time of the conjunction of the sun and moon in longitude. The next column states the greatest interval in minutes during which the most favored place may experience the total phase. The fourth column gives the latitude and longitude of the place where the eclipse is central at noon. The last column indicates the areas traversed by the moon's shadow. Several of the eclipses, occurring in the polar regions, have no noon-point and hence, for these, the place of the beginning or end of the eclipse, lowest in latitude, is placed in the fourth, and the corresponding time, sunrise or sunset, in the last column. The nine annular-total eclipses of the century are indicated by a \*, and in these the duration of total phase may be but a few seconds. Two of the list, namely 1928 and 1967, are non-central in character, the moon's shadow just grazing the pole of the earth.

It is not likely that the brief duration of total phase of a number of these eclipses will bar their astronomical use, particularly in the direction of spectroscopic and photographic investigations. The ever increasing importance of a thorough study of the rare and intricate phenomena of total solar eclipses, attested alike by the marvels still awaiting explanation, and by the progress already made, demands that every second of totality available shall be turned to the highest scientific uses.

*The Phenomena Observed in Total Solar Eclipses.*—As totality approaches, a pale purple coloring spreads over the landscape. Within a minute of the total phase the phenomena begin to succeed each other so rapidly that no single observer can note them all. By those glancing at the landscape in the direction of the approaching shadow a majestic darkness will be seen to sweep forward with a swiftness truly impressive. Those looking at the earth, and away from the eclipsing sun, will see a succession of flitting bands, alternately dark and bright, known as the *shadow bands*, which for many decades remained an unexplained puzzle. About 15 seconds before the total phase, the moon, with its sharp irregular outline, due to the elevations and depressions in its surface, will have diminished the solar crescent to such an extent that the remnant of it usually begins to be crossed by black lines.—the mountains on the moon's edge connecting the limbs of moon and sun. Then it rather suddenly presents the appearance of a string of detached brilliant points, irregular in size and spacing. These are the well-known *Baily's beads*, seen by Francis Baily on the occasion of the annular eclipse of May 15, 1836, and in an extended memoir on the remarkable phenomenon fully described. The explanation of the appearances was rightly suggested, as due to irradiation which alike exaggerates the length and thinness of the projected lunar mountains and the size of the resulting bright points or *beads* of the disappearing solar crescent. On each side of the point of disappearance, the chromospheric arc may be observed as a scarlet "sierra."

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TOTAL ECLIPSES OF THE SUN OCCURRING DURING THE TWENTIETH CENTURY.

Date of Eclipse, Central at noon.	Greenwich M. T. (Civil) in Longitude.	Max. Dur. of Total Phase	Locality of Eclipse Central at Noon Lat. Long.	Course of Moon's Shadow.
1901, May 18.....	h m 5 38	6.7	2° S 97° E	Sumatra, Borneo, New Guinea.
1903, Sept. 21.....	4 30	2.3	70 S 101 E	Indian Ocean, Antarctic Ocean.
1904, Sept. 9.....	20 43	8.2	5 S 133 W	Polynesia, Pacific Ocean.
1905, Aug. 30.....	13 13	4.0	45 N 12 W	Canada, Spain, Egypt.
1907, Jan. 14.....	5 57	2.6	39 N 89 E	Russia, Chinese Empire, Siberia.
1908, Jan. 3.....	21 44	4.5	12 S 145 W	Polynesia, Pacific Ocean.
1908,* Dec. 23.....	11 49	0.4	53 S 3 E	South Atlantic Ocean.
1909, June 17.....	23 29	0.5	88 N 173 W	Siberia, Arctic Ocean, Greenland.
1911, Apr. 28.....	22 26	5.4	1 S 155 W	Australia, Polynesia, Pacific Ocean.
1912,* Apr. 17.....	11 40	0.2	46 N 1 W	Spain, France, Germany, Russia.
1912, Oct. 10.....	13 41	2.2	35 S 33 W	Ecuador, Peru, Brazil.
1914, Aug. 21.....	12 27	2.4	71 N 2 E	Scandinavia, Russia, Persia.
1916, Feb. 3.....	16 06	2.9	16 N 62 W	Pacific Ocean, Isthmus of Panama, Venezuela, West Indies.
1918, June 8.....	22 03	2.5	51 N 152 W	Pacific Ocean, United States.
1919, May 29.....	13 12	6.1	4 N 18 W	Peru, Brazil, Central Africa.
1921, Oct. 1.....	12 26	...	84 S 19 W	Antarctic Ocean.
1922, Sept. 21.....	4 38	6.4	12 S 106 E	Indian Ocean, Australia.
1923, Sept. 10.....	20 53	3.8	38 N 128 W	Pacific Ocean, United States, West Indies.
1925, Jan. 24.....	14 46	3.3	42 N 44 W	United States, Atlantic Ocean.
1926, Jan. 14.....	6 35	4.4	10 S 82 E	Cent. Africa, Sumatra, Borneo, S. America.
1927,* Jan. 3.....	20 29	0.1	52 S 125 W	Pacific Ocean, South America.
1927, June 29.....	6 32	1.0	78 N 84 E	England, Scandinavia, Siberia.
1928, May 19.....	13 14	...	50 S 30 E	At sunset; Antarctic Ocean.
1929, May 9.....	6 32	5.5	1 S 89 W	Sumatra, Malay Peninsula, Borneo.
1930,* Apr. 28.....	19 10	0.2	45 N 113 E	United States, Canada.
1930, Oct. 21.....	21 47	2.2	36 S 155 W	Pacific Ocean, Patagonia.
1932, Aug. 31.....	19 55	1.9	79 N 100 E	British America, United States.
1934, Feb. 14.....	0 44	2.0	19 N 168 E	Borneo, Celebes, Pacific Ocean.
1936, June 19.....	5 15	2.7	56 N 101 E	Greece, Russia, Siberia.
1937, June 8.....	20 43	7.3	10 N 131 W	Pacific Ocean, Peru.
1938, May 29.....	14 00	4.3	52 S 27 W	South Atlantic Ocean, Antarctic Ocean.
1940, Oct. 1.....	12 41	5.9	19 S 16 W	Colombia, Brazil, South Africa.
1941, Sept. 21.....	4 39	3.7	30 N 114 E	Central Asia, Pacific Ocean.
1943, Feb. 4.....	23 31	2.8	47 N 176 W	Yezzo, Pacific Ocean, Alaska.
1944, Jan. 25.....	15 25	4.4	7 S 49 W	Peru, Brazil, North Africa.
1945,* Jan. 14.....	5 07	0.0	51 S 108 E	South Atlantic Ocean, Indian Ocean.
1945, July 9.....	13 36	1.4	70 N 20 W	United States, Canada, Scandinavia, Russia.
1947, May 20.....	13 44	5.6	2 S 25 W	Argentina, Paraguay, Brazil, Cent. Africa.
1948,* May 9.....	2 31	0.2	44 N 138 E	Chinese Empire, Yezzo, Pacific Ocean.
1948, Nov. 1.....	6 03	2.2	37 S 82 E	Central Africa, Indian Ocean.
1950, Sept. 12.....	3 29	...	34 N 115 W	At sunset; Arctic Ocean, Siberia.
1952, Feb. 25.....	9 17	3.5	22 N 39 E	Central Africa, Arabia, Central Asia.
1954, June 30.....	12 27	2.7	62 N 5 W	United States, Canada, Scandinavia, Russia, Asia.
1955, June 20.....	4 12	7.3	15 N 117 E	India, Siam, Philippine Islands.
1956, June 8.....	21 30	4.9	40 S 141 W	South Pacific Ocean, Antarctic Ocean.
1958, Oct. 12.....	20 52	5.4	26 S 139 W	Pacific Ocean, Argentina.
1959, Oct. 2.....	12 31	3.3	23 N 6 W	Atlantic Ocean, Morocco, Central Africa, Abyssinia.
1961, Feb. 15.....	8 11	2.9	53 N 53 E	France, Italy, Austria, Siberia.
1962, Feb. 5.....	0 11	4.3	4 S 179 E	Borneo, Celebes, New Guinea, Polynesia.
1963, July 20.....	20 43	1.8	62 N 126 W	Alaska, British America.
1965, May 30.....	21 14	5.6	4 S 137 W	Pacific Ocean.
1966,* May 20.....	9 43	0.1	41 N 31 E	N. Africa, Greece, Asia Minor, Central Asia.
1966, Nov. 12.....	14 27	2.2	38 S 43 W	Chile, Argentina, Brazil.
1967, Nov. 2.....	5 48	...	54 S 15 W	At sunrise; South Atlantic Ocean.
1968, Sept. 22.....	11 09	...	42 N 90 E	At sunset; Russia, Nova Zembla.
1970, Mar. 7.....	17 43	3.9	25 N 88 W	Mexico, Yucatan, Florida.
1972, July 10.....	19 39	2.8	67 N 111 W	Alaska, British America, Labrador.
1973, June 30.....	11 39	7.2	19 N 6 E	Venezuela, Central Africa.
1974, June 20.....	4 56	5.4	32 S 107 E	Indian Ocean, Southwest Australia.
1976, Oct. 23.....	5 10	5.0	31 S 95 E	Central Africa, Indian Ocean, Australia.
1977, Oct. 12.....	20 31	2.9	16 N 127 W	Pacific Ocean, Venezuela.
1979, Feb. 26.....	16 47	3.0	61 N 77 W	United States, British America.
1980, Feb. 16.....	8 52	4.4	1 N 48 E	Central Africa, India, Chinese Empire.
1981, July 31.....	3 53	2.2	54 N 127 E	Russia, Siberia, Pacific Ocean.
1983, June 11.....	4 38	5.5	7 S 111 E	Indian Ocean, Sumatra, New Guinea, Pacific Ocean.
1984,* May 30.....	16 48	0.0	38 N 74 W	Mexico, United States.
1984, Nov. 22.....	22 57	2.2	39 S 170 W	South Pacific Ocean.
1985, Nov. 12.....	14 20	...	52 S 146 W	At sunrise; Antarctic Ocean.
1986, Oct. 3.....	18 55	...	66 N 26 W	At sunrise; Arctic Ocean.
1987,* Mar. 29.....	12 45	0.4	6 S 17 W	Atlantic Ocean, Central Africa.
1988, Mar. 18.....	2 03	4.1	28 N 146 E	Sumatra, Borneo, Philippine Islands.
1990, July 22.....	2 54	2.7	73 N 142 E	Russia, Nova Zembla, Arctic Ocean, Siberia.
1991, July 11.....	19 06	7.2	22 N 105 W	Mexico, Yucatan, Venezuela, Brazil.
1992, June 30.....	12 19	5.5	26 S 5 W	South Atlantic Ocean.
1994, Nov. 3.....	13 36	4.6	36 S 31 W	Pacific Ocean, South America, South Atlantic Ocean.
1995, Oct. 24.....	4 37	2.4	10 N 110 E	India, Malay Peninsula, Polynesia.
1997, Mar. 9.....	1 15	2.9	71 N 154 E	Central Asia, Siberia.
1998, Feb. 26.....	17 27	4.5	6 N 81 W	Pacific Ocean, Panama, Venezuela, Atlantic Ocean.
1999, Aug. 11.....	11 08	2.6	46 N 18 E	Germany, Russia, Chinese Empire, India.

\* Annular Total Eclipses.

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Totality, the appearance of the prominences, whether *red* or *white*, along the moon's edge, and the presence of the radiant, outspreading corona, are simultaneous. The phenomena of the earlier eclipses were recorded in the most general manner. Hasty drawings of the streamers of the corona, accompanied by descriptions reflecting but the dawn of scientific method, are the chief results. It was not until the application of the spectroscope and the photographic camera that the astronomer attained real insight into the stupendous phenomena.

The great eclipse of July 8, 1842, may be said to mark the beginning of serious and accurate attention to the complex physical features of total solar eclipses. Then the path of totality swept from Spain across France, Italy, Austria, Russia, and central Asia, and thus permitted many expert European astronomers to view and record the marvelous phenomena. It is noteworthy that in reports of this eclipse the red solar prominences were first described with precision, three large ones having been seen on the upper edge of the moon. The corona was also described as of a brilliant white luminosity and extending at least 15' from the moon's edge. Among the many phenomena observed, the objects of special speculation were the newly discovered *red flames* or *protuberances* which Baily considered as "evidently forming a portion of the corona," and no less an authority than Airy, who had observed the eclipse through clouds, attributed to "some irregularity in the density of the cloud's edge."

The total solar eclipse of July 28, 1851, carrying the moon's shadow across Greenland, lower Sweden, and Russia, is notable as being probably the first for whose observation distinct aid was given by government authority, since with the assistance of the admiralty, the British astronomer royal, Airy, was able to conduct an important expedition to Sweden. Both the corona and the prominences were observed in greater development than in 1842, and by several observers a scarlet *sierra* or reddish arc of light was noted near those parts of the lunar disk where the rays of the sun had disappeared, or else were about to appear. The observers for the most part became certain that the prominences were true solar appendages, because they were apparently uncovered by the moon's edge on the western edge, and extinguished on the eastern limb. A precious photographic achievement was the single successful daguerreotype taken by Barowski with a telescope of 2.4 inches aperture, attached to the Königsberg heliometer, and with an exposure of 84 seconds. It distinctly pictured the corona and several prominences, and thus became the first unchallenged record of these features of an eclipse.

It was, however, at the eclipse of July 18, 1860, which traced its total path across northern Spain, the Mediterranean, and northeastern Africa, that photography was first applied with marked scientific success. Mr. Warren De la Rue, stationed at Rivabellosa with the Kew photo-heliograph, and Padre Secchi, at Desierto de las Palmas, with the Cauchoix refractor, each secured good representations of the prominences; the former also faint traces and the latter good portrayal of the corona. Comparison of these photographs set at rest, once for all, any doubt

still existing as to the true solar character of the prominences. The moon was undeniably shown to pass over them, and all the speculation which had attributed these strange scarlet projections either to lunar, or to terrestrial origin, was at an end. Many sketches of the corona, or of parts of it, had been made during this eclipse, some showing its extension to fully one degree. But Padre Secchi's plates, although depicting the corona as scarcely a quarter of a degree in width, exhibited the whole of it in great delicacy of tone and as traversed by curious dark rifts. The method of making hasty sketches and drawings of the corona had, as shown by the results of this and previous eclipses, brought no end of contradiction and had permitted comparison only in some of the most pronounced features. It was therefore destined more and more to fall into discredit, and to have its results accepted only as rude and preliminary. The photographic method of attacking the problems arising in total solar eclipses was from this time firmly established. Its progressive development was determined chiefly by three elements: First, increase in the sensitiveness of the plates; second, knowledge of the exposure times required; and third, necessary advancement in practical optics. The gelatin emulsion process introduced by Maddox in 1871, and given the touch of great sensitiveness by Bennett, in 1878, secured the first. Successive failure and success, coupled with scientific method in photometric study, brought the second. And, finally, refined theoretical discussion of the principles of optics as applied to celestial photography, coupled with marked improvements in optical manufacture, supplied the third. So that now by separate and regulated exposures, with specially designed instruments, either the outer long, delicate, coronal wings may be pictured to an extreme limit, or the intensely brighter parts of the inner corona, shown with all their involved filaments and rich tracery, and with many a curious relation to the prominences and chromosphere.

The unknown nature of the brilliant red prominences, boldly projecting beyond the moon's edge during an eclipse, had for a quarter of a century remained an unaccepted challenge. And hence the first and highly successful application of the spectroscope to their study during the total solar eclipse of Aug. 18, 1868, will always be memorable. Tracing its course across the Indian and Malayan peninsulas, and affording a total phase of more than five minutes and a half, this eclipse was spectroscopically observed by Janssen, Major Tennant, Lieutenant Herschel, Pogson, and Rayet. The light of the prominences was recorded by each of these experts as consisting of several bright lines clearly indicative of the gaseous nature of those remarkable objects. The hydrogen lines C and F were certainly identified, and a yellow line, thence to figure famously in astronomy as D<sub>2</sub> and as due to *helium*, was too hastily assigned to sodium. Another notable result of this eclipse was the discovery, by Janssen, of a method by which the bright lines of the prominences could be observed apart from any eclipse whenever the sky was sufficiently clear. "During the total obscurity, I was struck by the vivid splendor of the light of the protuberances; the thought immediately came to me that it would be possible to see them irrespective of eclipses," his

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famous report begins. On the day following the eclipse he was able successfully to apply the new method; to demonstrate beyond controversy that the bright lines of hydrogen prevailed in the protuberances; and to make a third discovery always to be associated with this great Indian eclipse, namely, that of pronounced and rapid changes of form occurring in the prominences. Lockyer in England had for some time been at work on the same method for observing the bright prominence lines, and his final success was reported to the French Academy at the same meeting at which Janssen's achievements were announced. The coincidence was evidently rather determined by the progressive advancement of spectroscopic science than by accident. Huggins, who had previously indicated the theory of the Janssen-Lockyer method now suggested the widening of the spectroscopic slit as a means of disclosing the entire form of a prominence in a spectroscope of considerable dispersive power. The spectrum of the corona of this eclipse was generally observed as a faint continuous one without lines dark or bright. Rayet, indeed, noticed a certain bright line near E as extending above the prominences. The polariscopic observations of Lieutenant Campbell and Captain Branfl proved that the coronal light was polarized in planes passing through the sun's centre. The inference thus seemed doubly plain that some solar light was reflected by the corona, although the absence of the dark Fraunhofer lines required explanation.

The path of the moon's shadow during the total eclipse of August 7, 1869, lay diagonally across North America from Bering's Strait to North Carolina. The spectroscopic observations made in Iowa, at Burlington by Professor Young, and at Des Moines by Professor Harkness, established the existence of a bright green line crossing the continuous spectrum of the corona. It was estimated by the former as coincident with an iron line at 1474 of Kirchhoff's scale, or of a wave-length ( $\lambda$ ) of 5317 ten millionths of a millimetre; and by the latter as at  $\lambda 5300 \pm 14$ . Professor Young's reading for the line of the unknown *coronium*, as it came to be designated, was practically that of a bright chromospheric line of approximately the same wave-length, shown by his observations some time prior to this eclipse. Young in 1876 by means of a higher dispersion proved 1474 K to be double. But it remained for the photographic records of the powerful spectrographs applied to the eclipses of 1896 and 1898 to furnish the data according to which Lockyer, Campbell, and Evershed could place the famous coronal line definitely at  $\lambda 5303$  and thus separate it from its neighbor in the chromosphere.

The eclipse of December 22, 1870, trailing its path of totality over southern Spain, Sicily, and Greece, was of particular interest to the American observers who had studied that of 1869, and this resulted in the despatch of two large parties to Europe, one directed by the United States Naval Observatory and the other by the officers of the Coast Survey. If there remained any doubt as to the gaseous nature of the inner corona it was to be dissipated by the fine drawing and description of the inner corona furnished by Professor Watson of Ann Arbor, stationed at Carlentini, Sicily, and observing this gaseous shell to an elevation of about 5'; and by Profes-

sor Young's observations in Spain at Jerez de la Frontera, of the now familiar green line of coronium, visible plainly in this area, and traceable as far as 16' from the solar limb. The bright hydrogen lines C and F and the helium line D<sub>3</sub> were seen projected on the moon, and also about 5' outside of the lunar limb by Young. Plainly the light of the prominences and chromosphere must have been reflected from the earth's atmosphere, and possibly also from the corona itself, and commingled with its intrinsic radiation. This eclipse will, however, always be peculiarly famous for Professor Young's discovery of the *reversing layer* as a thin shell lying immediately above the photosphere. Kirchhoff's theory had demanded the existence of a solar atmosphere of vapors above the photosphere, which by its elective absorption should produce the dark lines of the solar spectrum. Janssen had expected to see the reversed solar spectrum in 1868, but in his notable report was obliged to say: "It must be admitted either that this atmosphere does not exist, or that its height is so meagre that it has escaped observation." Peculiarly interesting then for this time, and for the future, was Young's observation of a sudden bursting forth, at the disappearing solar edge, of innumerable bright lines having the general arrangement of the familiar dark lines of the spectrum. The existence of the reversing layer has since 1870 been repeatedly verified visually, and more recently by photographic records. The layer comprises an envelope of glowing vapors of an estimated depth of about 600 miles lying at the base of the chromosphere. Its thinness causes the bright lines to appear for but a few seconds, or as a brief *flash*, unless the observation be made at some station near the edge of the lunar shadow. Photographs of this eclipse taken by Willard in Spain, and by Brothers in Sicily, exhibited the corona as divided by the same rifts as shown in Watson's drawing, and, although differing in extent of corona depicted, markedly agreed in all details to be expected in plates exposed for different intervals and in cameras of widely different light-grasp. Incidentally the advantage of large angular aperture in a camera intended to trace the considerable extent of the corona became evident. In photographs by Brothers, at Syracuse, the corona was traceable to a height of at least 40' above the sun's limb.

The eclipse of December 12, 1871, whose path lay across southern India, and northern Australia, was photographed with similar instruments according to a consistent plan by Davis at Baidkal, and Tennant at Dodabetta, and these photographs subsequently studied with consummate skill by Ranyard and Wesley, and the delicate results reproduced in detail with masterful accuracy. (Vol. XLL, 'Memoirs Royal Astronomical Society.') Here for the first time was available a representation of the corona in all its complex glory of spaced polar rays, dark rifts, filaments straight, curved, and interlacing, and of stupendous *synclinal* structures with rich nebulous mottling. The delicate portrayal of the wet-plate process was only equaled by the scientific and artistic appreciation of Ranyard and Wesley in integrating the noble results. Double charm and value was added to the photographic achievements by the vivid and accurate descriptions of the corona



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at Baikal by Lockyer, at Dodabetta by Captain Herschel, and at Shoolor by Janssen. In the spectrum of the corona four hydrogen lines and 1474 K were seen both by Lockyer and Janssen, and in it the latter also found the dark line D and several faint dark lines in the green.

The eclipse of April 16, 1874, was visible only in southern Africa, and observed at Klipfontein by Mr. E. J. Stone, the astronomer royal of the Cape Observatory. He confirmed Young's observation of the reversal of the Fraunhofer lines near the photosphere, and traced the main, green coronal line to more than a degree from the moon's edge. The corona exhibited extended equatorial wings, covering in some parts more than three lunar diameters. The spectroscopic character of the corona, and its unchanged features, as viewed from different stations in Africa, led Stone to insist on the solar origin and cosmical nature of the outer corona.

The eclipse of April 6, 1875, traced its total path across Siam and French Indo-China, and in the former country was observed by Lockyer, Schuster, and Janssen, who obtained photographs of the corona showing that its extent increased rapidly with increasing times of exposure. Photographs were also secured with a prismatic camera which for the upper corona gave apparently H $\gamma$ , and for the lower parts of the corona, a strong continuous spectrum. The corona was of a type similar to that of the previous year, exhibiting a marked symmetry, and four synclinal groups making angles of more than 45° with the sun's axis.

The path of the total solar eclipse of July 29, 1878, lay diagonally across North America from Bering's Strait to the Gulf of Mexico, and afforded a memorable opportunity to many American and foreign astronomers. The direction of the line of totality across the Rocky Mountains permitted several astronomers to observe the phenomena at extraordinary altitudes. Langley on Pike's Peak, at an altitude of 14,100 feet, traced the corona in the direction of the ecliptic for a distance of at least 12 lunar diameters, and felt great confidence in saying that this, though covering a range of over 10,000,000 miles, was "but a portion of its extent." The eminent astronomer Newcomb, although observing at a lower level, Separation, Wyoming, made his very careful estimate of the length of these coronal wings "as six degrees from the disk." The polar rays and filaments of the inner corona received careful study from such experienced observers as Ormond Stone, Boss, Paul, Trouvelot, and Upton. The dry-plate photographs obtained by Professor Hall's party at La Junta, and by Professor Harkness' party at Creston, were in remarkable agreement as to the details of the inner corona, the same intensities of shading, to great delicacy, being in common, and the pronounced filamentous character of the polar rays, as well as the marked curvature and brightness of the equatorial extensions being clearly shown in both sets of plates. A photograph made by a member of Professor Holden's party by means of a small camera showed the east wing of the corona as extending 50' from the moon's edge. It was the concurrent opinion of many observers that although the corona exhibited vast wings, it lacked, particularly in its inner portions, the brilliancy of the corona of 1869.

As to the spectroscopic observations made by himself and others, Professor Young distinctly announced that they demonstrated a profound modification of the coronal spectrum; the bright lines of former eclipses, especially the 1474 K, having proved to be very faint and difficult of observation. The gaseous corona manifested, as it seemed, a pronounced sympathy and intimate relation with the eleven-year sun-spot period, giving faint spectroscopic lines at the minimum, 1878, and brilliant ones at the maximum, 1869, 1870, and 1871, of the period. Ranyard in his report on this eclipse, inspired by his recent observations and by his former masterful study of previous eclipses, made the deduction that "a greater development of the corona in the equatorial than in the polar regions is one of the characteristics of coronas which have been observed during periods when there were few sun-spots." The search made by Watson and Swift for an intra-Mercurial planet proved to be doubtful in result.

The total eclipse of May 17, 1882, visible in the Sudan, upper Egypt, and across to China, was in Egypt observed by Sir J. Norman Lockyer, Professor Schuster, Professor Tacchini, and by a French expedition equipped by M. Bischoffsheim. The photographs of the corona reproduced the form which it had in 1871, also near a sun-spot maximum, being most extended at points away from the solar equator and with no special structure at the poles. It was thus distinguished from the coronas of 1878 and 1867: near sun-spot minima, which were greatly elongated along the sun's equator and of marked structure at the poles. A striking object was a bright comet near the sun, photographed, as well as observed by the naked eye, and the first discovered on such an occasion. The spectral lines, C, F, D $_3$ , H, and K, were observed in the corona. A photograph made by Lockyer with a prismatic camera gave continuous rings corresponding to 1474 K and D $_3$  for the corona. Professor Tacchini, through observations made during the eclipse on the size of the prominences, found that these appeared approximately twice as high and twice as wide at the base as the same prominences had prior to the eclipse, as observed by himself in Egypt, and by Professor Ricco at Palermo.

The eclipse of May 6, 1883, carried the track of the moon's shadow across the south Pacific. It was observed from Caroline Island, an atoll in the Polynesian group, by a number of astronomers from Europe and America. Professor Holden was in charge of the American expedition, and devoted himself to a careful search, during the long totality of 5 minutes 23 seconds, for an intra-Mercurial planet, with a negative result. Palisa of Vienna, assisted by Trouvelot, also engaged in the same search, and with like result. Professor Hastings having under view simultaneously the spectra of the eastern and of the western sides of the corona, observed the green line at beginning of totality as extending brilliantly about 12' from the eastern limb, but fainter and about 4' from the western limb; and at the end of totality these conditions reversed. He also saw the D line dark in the corona. Janssen, devoting himself specially to the detection of the dark Fraunhofer lines in the coronal spectrum, saw not only the principal lines, notably B, b, E, etc., "so marked that there was

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no possible doubt in that respect," but all told, "about 100 lines." Tacchini observed two lofty, finely silvered sheaves which he designated, *white prominences*, "protubérances blanches." He also thought he had detected the cometary carbon bands in the coronal plumes.

The eclipse of September 9, 1885, was visible on land in New Zealand only, and owing to bad weather yielded scarcely any scientific result. The corona was of a stellate character, the streamers extending in many directions. A brilliant prominence reported as *white* as well as *red* by different observers shot out near the main rift.

The eclipse of August 29, 1886, was visible in its total phase in a path extending from the Isthmus of Panama, across the Atlantic Ocean, and South Africa, to the Indian Ocean. It was observed by American, English, and Italian astronomers in the West Indies. Professor W. H. Pickering, of the Harvard College Observatory, made a valuable investigation in the photographic photometry of the corona, the result of which led Holden to employ a similar method in the two eclipses of 1889. The values obtained are given in connection with the later eclipses. The Harvard photographs of the eclipse were taken with a variety of cameras, the short exposures giving the details of the inner corona, and one, of long exposure, showing the corona as extending 90' from the moon's limb. In the largest prominence of the eclipse, rising in a somewhat spiral form to the altitude of 150,000 miles, W. H. Pickering photographed only H and K lines with a faint trace of an ultra-violet line, while in the other prominences the hydrogen lines also were present. By means of this prominence Tacchini verified his discovery of *white* prominences and immediately announced to the Academy of the Lincei at Rome: "That during a total solar eclipse of the sun there may be seen most beautiful prominences not visible in full sunlight; that the prominences visible only during totality are white, especially in their more elevated parts, and have a special filamentous character, the threads being thin, long, and blunt at the top; that the luminous intensity of the white prominences is feeble, and for this reason they are not visible to the naked eye, unless their height surpass that of the more brilliant parts of the corona; and that the other prominences visible in full sunlight appear much wider and higher in a total eclipse, and,

spectrum showed many lines which on comparison with those of 1882 exhibited a great alteration in intensity. The hydrogen lines were visible in the corona only in the parts overlying strong prominences, while the H and K lines, though elsewhere visible, were stronger on the side of the corona having many prominences at its base. A drawing of the corona by W. H. Wesley, and one of the richest products of this eclipse, is based on seven negatives by Maunder, and five by Schuster, and exhibits a stellate distribution of the streamers.

The eclipse of August 19, 1887, whose line of totality lay across Russia and Japan, was notable for the extensive and complete preparations made to observe it, and for the general failure through cloudy weather. In this disappointment shared Struve's plan of measuring the precise ratio of the apparent lunar and solar diameters by means of a series of co-operative observations along the northern and southern boundaries of the shadow. A comparison of photographs of the corona taken at Petrovsk, Russia, and those taken two hours later at Youmei-yama, Japan, was probably too careless to prove the supposed displacement of one of the streamers.

The total eclipse of January 1, 1889, was visible in a path that lay across California and Nevada, and was successfully observed by many American astronomers. The photographs taken are notable alike for the fine detail of the inner parts of the corona registered, and for the immense extent of the streamers imprinted. A particularly fine negative by Barnard permitted Holden to trace rays similar in typical character to the polar rays all round the limb of the sun and to present a detailed study of the filamentous character of the corona. Professor Holden also drew the conclusion that: "Coronal forms seem to vary periodically as sun-spots and auroræ, and the coronas of 1867, 1878, and 1889 are of the same strongly marked type"; thus confirming Ranyard's previous deduction. Professor Charropin's negatives disclosed the corona out as far as 100' or more, and confirmed many of Barnard's delicate details in the filaments and the trumpet-shaped extension of the outer corona. The outlines of the coronal wings were shown in the photographs of Ireland and Lowden as far as 135' and 165' respectively. Señor Valle was able to trace the streamers, with the naked eye, to a distance of more than three degrees. The coronal spectrum was character-

Photographic Photometry of the Solar Corona	August 1886 Pickering	January 1889 Holden	December 1889 Holden
Intrinsic actinic brilliancy of the brightest parts of the corona.....	0.031	0.079	0.029
Ditto of the polar rays.....	.....	0.053	0.016
Total actinic light of the corona.....	37.	60.8	26.2
Ratio of total coronal to total sky light (actinic).....	1 to 1400	1 to 3043	1 to 1285
Ratio of intrinsic brilliancy of the brightest parts of the corona to that of the sky (actinic).....	44 to 1	16 to 1	32 to 1
Magnitude of the faintest star shown on the eclipse photographs .....	.....	2.3	.....

when of considerable height, have their summits white." Captain Darwin, using an instrument designed by Huggins for testing the possibility of obtaining photographs of the corona at other times than during eclipses, secured negative results. Schuster's photographs of the coronal

ized by simplicity and consisted of few lines other than those of coronium and hydrogen.

The eclipse of December 22, 1889, was observed by Burnham and Schaeberle at Cayenne, South America, and by Father Perry in the Salut Islands, French Guiana. This devoted astrono-

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mer died, a few days after the eclipse, from the exposure to the dangerous malarial climate. The American and English expeditions at Cape Ledo, Africa, experienced cloudy weather. The main results of the measures in the photographic photometry of the corona made by Professor W. H. Pickering in 1886, and those deduced by Professor Holden from the eclipses of January and December 1889 are based on a standard giving fairly comparable results, and are presented in the preceding table. The photographs of January 1889 are the only ones of the group taken in a clear sky, and this the photometric results clearly indicate.

From a thorough study of his photographs of the eclipse of 1889, Prof. Schaeberle published 'A Mechanical Theory of the Solar Corona,' in which he holds that the "corona is caused by light emitted and reflected from streams of matter ejected from the sun by forces which, in general, act along lines normal to the surface of the sun; these forces are most active near the centre of each sun-spot zone." "The perspective overlapping and interlacing of the streamers cause the observed apparent variations in the type of the corona." From a study of his plates of the eclipse of 1893 he so modifies his theory as to conclude that the stream lines of the corona coincide with "elliptical arcs having one focus at the sun's centre; the origin of the streams being, in the main, confined to the spot-zone regions." Professor Schaeberle applies his theory to the location of half a dozen solar areas productive of the actual streamers photographed in the eclipse of 1893. Whatever the merit of the particular theory, it has had the advantage of pointing out the importance of dynamical and spatial study of the coronal streamers.

The eclipse of April 16, 1893, traced its course of totality from Chile northeast across South America and the Atlantic Ocean into West Africa. It was observed both in Africa and Brazil by English and French astronomers. At Mina Bronces, Chile, Professor Schaeberle, of the Lick Observatory, as Bigelow and Davis in 1889 at Cape Ledo, employed a long focus telescope (5 inches aperture and 40 feet focal length) in the photography of the corona. This he set up in the direction of the computed place of the eclipsed sun and obtained notable delineation of the protuberances and the corona near the solar limb. A comet formed a fairly conspicuous feature of the corona on Professor Schaeberle's plates. Professor Hale, from a detailed comparison of photographs of the prominences made in full sunlight by himself at Chicago, and of eyetracings made by Fényi at Kalosa, with those taken during this eclipse by Schaeberle in Chile, and by Fowler at Fundium, Africa, demonstrated the resemblance of the prominences as photographed in the K line to those of the eclipse, and marked differences in those as seen in H $\alpha$ . Professor Hale also indicated that the *white* prominences probably appear so from the intense character of the H and K light. Prismatic cameras of considerable light-grasping power were used by Fowler in Africa, and Shackleton in Brazil, and from a comprehensive discussion of the photographs, Lockyer concluded that the spectrum of the corona in 1893 consisted, besides that of coronium with a wave length of 5303, of at least seven rings of  $\lambda\lambda$  3987; 4086; 4217; 4231; 4240; 4280; and 4486, which had also

been seen in slit spectroscopes in 1886 and at other eclipses. The H and K lines, as well as those of hydrogen and helium, seen hitherto in the corona, by a number of observers, must therefore be attributed to a scattering of the prominence light by the earth's atmosphere, and possibly by the corona itself but not to the intrinsic coronal light. The English photographs also permitted the determination of the wavelengths and intensity of several hundred chromosphere and prominence lines. Abney and Thorpe made photometric observations of the corona which disclosed a close agreement with those made by them in 1886, and indicated a brightness of the corona not dissimilar in both eclipses. Deslandres sought to determine the rotation of the corona by photographing its spectrum on both sides of the sun, but through his use of the H and K lines only, his result, of a speed almost equal to that of the solar surface and corresponding to a distance of 20' from the limb, cannot be regarded as conclusive. De la Baume Pluvine! photographed at least 15 Fraunhofer lines in the coronal spectrum, and thus confirmed Janssen's previous observation. The form of the corona was described by several astronomers as that peculiar to the epoch of the maximum of sun-spots. Bigourdan explored the neighborhood of the sun for intra-Mercurial planets with negative result.

The eclipse of August 9, 1896, was visible in its total phase in Norway, Nova Zembla, and northern Asia. Notwithstanding the unfavorable character of the weather, excellent photographs were secured by Baden-Powell and by several Russian astronomers. The report of Hanksy on the fine photographic results led him to a clear exposition of the relations of the forms of the corona to the sun-spot period, which has won marked attention and approval. His general prediction of the form of the corona of the eclipse of 1900, as made in his memoir, has been verified. Belopolsky adds another dynamical conception of the corona, in that he infers that, by the general eruption at the sun-spot maximum, matter is ejected into the surrounding corona and thus communicates its higher speed of rotation to the outer corona so that gradually the polar regions are laid bare and by the time the minimum sun-spot period arrives the coronal figure has broadened out into vast equatorial extensions. Both Russian and British photographs show some of the prominences with dark borderings or outlines, and in the former these veins suggest the dark interstices of a series of hoods above the prominences. Shackleton, with signal success, photographed the spectrum of the *reversing layer*, and demonstrated the coincidence of many of the lines with the Fraunhofer spectrum. It was thus for the first time that Professor Young's observation was photographically confirmed.

The path of the total eclipse of January 22, 1898, lay across east central Africa, India, and the Chinese empire. The eclipse was successfully observed by many astronomers and furnished a great wealth and variety of photographic material. Campbell, of the Lick Observatory, in the Crocker eclipse expedition to Jeur, India, employed an objective-grating spectrograph which was so arranged as to give a continuous photographic account of the changes in the solar

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spectrum at second and third contacts. Many interesting results of differences of level and of intensity of radiation in the lines were obtained. An exposure for the coronal ring at  $\lambda 5303$  gave it in a very remarkable form which shows its principal masses to lie in the sun-spot zones. Professor Campbell also found that the source of the continuous spectrum of the corona had the same form as the monochromatic ring just mentioned. It is from the results of this eclipse that Campbell, and later Evershed, deduced the wave-length 5303 for coronium, now universally accepted. The British results obtained with the large prismatic cameras permitted Lockyer to give the wave-lengths of 45 coronal rings arranged in three groups defined by the position angle in which they have their greatest brightness. The different forms of the coronal rings seemingly indicate that they are due to at least three substances whose typical wave-lengths are at 5303, 3987 and 4359. A table of wave-lengths of more than 900 lines in the spectrum of the chromosphere resulted from the photographic spectra. With a small prismatic camera Evershed obtained highly valuable results. His spectra gave measured values of 29 of the hydrogen lines closely agreeing with the values computed by Balmer's formula. A remarkable band of continuous spectrum shown by the prominences and lower chromosphere and beginning in the ultra-violet end of the Balmer hydrogen series (see SPECTROSCOPY), he attributes also to hydrogen. In the flash spectrum the position of almost all the bright lines appears to coincide with dark lines in the solar spectrum, but the relative intensities of the lines in the two spectra are widely different. The dissimilarity in the relative intensities of lines of different elements in the two spectra is attributed to the unequal heights to which the gases of the various elements ascend in the chromosphere, and Mr. Evershed hence concludes, that "the wide divergence between the flash and Fraunhofer spectra with respect to intensities, would appear, therefore, to afford no ground for abandoning the original interpretation of the flash proposed by Young from his observation in 1870, and the evidence of these photographs certainly indicates that the flash does in fact represent the upper, more diffused portion of a true reversing stratum." Professor Campbell's Jeur photographs of the corona made with the 40-foot telescope show a great wealth of detail. One of two seconds' exposure, clearly indicates the ultimate relation of the prominences with the synclinal structure of the corona; another, of eight seconds, gives a fine representation of the polar rays and rifts with a coronal form already clearly influenced by the approaching sun-spot minimum. Professor Burckhalter, using a special appliance for regulating the relative exposure given to the inner and outer portions of the corona, obtained a good representation of its entirety, which, however, still showed over-exposure for the inner details. A fine photographic representation of the four principal streamers of the corona was obtained by Mrs. Maunder, which showed them to distances from the moon's centre of three, four, four and a half, and six diameters respectively.

The total solar eclipse of May 28, 1900, will always be famous for its long course through

civilized territory, its path crossing the United States from Texas diagonally to Virginia, and finally threading its way across Spain. It is chiefly memorable for the fine weather which prevailed along the track of totality, and for the magnificent array of optical and physical appliances employed in its observation. The chief American parties were those of the Lick, Yerkes, Allegheny, Smithsonian, Princeton, Brown, Harvard, and United States Naval observatories, conducted respectively under the direction of Campbell, Hale, Wadsworth, Langley, Young, Upton, W. H. Pickering, and S. J. Brown. Long focus telescopes either directly pointed at the sun or fed by cœlostats for coronal photography, huge Rowland grating spectrographs for photographing the flash, and the delicate bolometric appliances of Hale and of Abbot characterized the instrumental attack. The large photographs of the corona by Campbell with telescope of 40 feet focus, directly pointed, by Barnard with lens of 61.5 feet focus, and by Smillie with lens of 135 feet focus, gave a fine representation of the inner corona and prominences. The great prominence in the southwest quadrant was a mass of filaments. Its white summit in eruptive activity was visually observed by the writer. Striking changes in this prominence and in others are seen on comparing the American photographs with those of Christie, the astronomer royal, taken at Ovar, Portugal, and of Lockyer, taken at Santa Pola, Spain, about two hours later. The study of the form of the corona as presented by the photographs was of special interest since Professor Bigelow's precise forecast seemed in the main to be verified when compared with Jewell's fine drawing reproducing the corona from photographs. Already in 1891 Bigelow had computed the direction of the coronal streamers for the corona of 1878 and for the two coronas of 1889 on a "polarization theory" in which the coronal lines were shown to lie in the direction of the lines of force surrounding a spherical magnet. Such magnetization of the sun, although suggested, was then not necessarily assumed. The progress of physical science later made it probable that matter on the solar surface was electrically ionized after the manner of the cathode streams of the Geissler tubes. And these electrified particles, or electrons, required then only to be directed by a supposed magnetic field of the sun. Bigelow's "Magnetic Theory of the Corona," supported by Eberts' experiments, seems likely both from the natural assumptions made, and from the deductions allowable, to furnish the master-key to the mysteriously definite arrangement of the corona at the sun's minimum of activity, so characteristic of the eclipses of 1900 and 1901. The modifications yet necessary to account for all the probable solar phenomena as pointed out by Bigelow, Schaeberle, Scheiner, Ebert, Perrine, Abbot, Arrhenius, Dr. Lockyer, and others cannot be foreseen, but it seems likely that we are rapidly approaching conceptions which will correlate not only all coronal, but all solar phenomena satisfactorily. Professor Burckhalter, by means of his method of regulating the relative exposure of inner and outer parts of the corona, attained remarkable success in photographically depicting the details of the entire corona.

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The spectroscopic observations were manifold and in the main successful. Professor Frost, of the Yerkes Observatory, operating with a prismatic camera of very high dispersion, and two grating spectrographs, photographed and measured some 800 lines. He regards spectra of the cusps taken within 30 seconds of the contacts, and as produced by the powerful instruments he employed, as valuable as those taken at the precise instant of contact. A red sensitive plate was exposed to the coronal spectrum by Professor Frost, and registered rings at  $\lambda\lambda$  4230, 4341, and 4358. Professor Lord, employing a prismatic camera, obtained excellent photographs of the flash, which enabled him to determine the accurate wave-lengths of several hundred chromospheric lines. Professor Wadsworth's photograph of the flash spectrum by means of a concave grating objective spectroscope of special type induced his thorough investigation of the optical theory of such appliances which ranks among the very choicest results of the memorable eclipse of 1900. Indeed, Wadsworth's masterful discussions are inseparable from the proper estimate of results of previous observers and furnish a trustworthy guide for future spectroscopic work, of a high degree of accuracy, in eclipses. Sir Norman Lockyer, observing in Spain, determined the wave-lengths of many prominence lines and the heights of the various chromospheric vapors. His comparison of the green coronal ring with the inner and outer corona showed that there is no apparent connection between the points of greatest brightness of the coronal rings and the positions of the prominences, and that the brightest parts of the green coronal ring correspond intimately with the brightest parts of the inner corona, but are not in apparent relation with the outer corona. Professor Evershed, observing in Algiers, just outside of the path of totality, obtained photographs of the flash spectrum in high solar latitudes, and concludes that, in its main features, it is the same as in low latitudes. He verifies the essential identity of the flash spectra as photographed by Shackleton in 1896 and those obtained in 1898 and 1900, and infers that "the flash spectrum is probably as constant a feature of the solar surface as is the Fraunhofer spectrum." In discussing the detailed spectroscopic results of the flash layer, Evershed infers that the abnormal intensities of the enhanced lines characteristic of all levels and all latitudes of the flash is due to a continuous circulation of the solar gases in a radial direction, while the cooler, more diffused gases, in their subsidence, determine the character of the absorption spectrum. His final conclusion is "that the flash spectrum represents the emission of both ascending and descending gases, while the Fraunhofer spectrum represents the absorption of the descending gases only." Professor Deslandres, by means of spectrographs with optical parts of Iceland spar and quartz, photographed the entire ultra-violet spectrum of the reversing layer from  $\lambda$  4000 to  $\lambda$  3000, the entire ultra-violet spectrum of the upper chromosphere, and the entire spectrum of the corona with two new coronal rings. Deslandres, observing visually with a powerful grating, inferred from the inclination of the green coronal line on the east side of the equator that the corona appeared to have a more

rapid rotation than the disk. He remarked the feebleness of the green line characteristic of minimum solar activity. Professor Dyson, of the Portugal expedition of Christie, the astronomer royal, with spectroscope of quartz lenses and prisms, obtained a fine series of spectra of the sun's limb near the beginning of totality, and spectra of the corona. Professor Turner secured photographs, in polarized light, of the corona, permitting of a quantitative investigation. The polarization of the corona was radial and was "not only shown in the outer streamers, but right up to the moon's limb." An important bolometric measure of the heat of the corona was conducted by Abbot and Mendenhall, of the Smithsonian Observatory, which led to the conclusion that the corona neither reflects much solar light nor in the main gives light of its own on account of high temperature, "but seems rather to be giving light in a manner not associated with a high temperature, or at least with the preponderance of infra-red rays usual in the spectra of hot bodies." This result plainly points to the electrical character of the coronal light and is also in harmony with Bigelow's magnetic theory. Deslandres, using "a very sensitive Melloni pile" for detecting the heat of the corona, reports positive indications which are in strange contradiction with Abbot's results and intensify the regret at the accident which befell Hale's bolometric appliances at the critical moment. The heat measures in future eclipses will have an exciting interest in relation to coronal theory. The shadow bands were perhaps more systematically observed at this eclipse than at any other. The United States Weather Bureau carried out an extensive system of observation from which Professor Bigelow drew the conclusion that "the shadows were crescent-shaped and had a flickering motion, as if struggling through two or more conflicting movements in the atmosphere itself." Professor Elihu Thomson, observing at Barnesville, saw the bands "curved and broken, not complete lines," and immediately after totality, two sets of bands moving in opposite directions "as if due to opposing air currents at different altitudes." As a further confirmation that the bands are due to different air currents, the larger bands were seen to move in the direction of the wind. The different sets of shadow bands are probably produced by the shifting refraction due to the waves of warm and cool air at the different altitudes.

The total eclipse of May 18, 1901, traced its path across southern Madagascar, the Indian Ocean, Sumatra, Borneo, the Celebes and New Guinea, and, on account of its long duration of over six minutes and the high altitude of the sun at the best points of observation, attracted expeditions from the Netherlands, the United States, Great Britain, France, Russia, and Japan. The general weather conditions unfortunately proved to be unfavorable. At a few of the eclipse stations, however, observations of great value were made. Professor Perrine, observing at Padang, Sumatra, through a partly clear sky, obtained excellent results. His photographs showed "conspicuous series of coronal hoods," and also "a remarkable coronal disturbance resembling an inverted cone of considerable angle" and unlike anything previously recorded. This disturbance associated with a long thread-like



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prominence, Professor Perrine, subsequently, by means of the Greenwich solar negatives taken at Dehra Dûn, India, traced to a sun-spot and associated facule, near the solar limb on the day of the eclipse, and thus plainly exhibited faculæ, prominences, coronal disturbance, and sun-spots in a common origin and intimate relation. This wonderful phenomenon was without doubt due to a solar eruption which took place near the solar limb and at, or just prior to, the time of the eclipse. The spectrographs specially designed and prepared for photographing the delicate Fraunhofer lines of the corona by Professors Campbell and Wright proved very efficient in the hands of Perrine and gave a band of continuous spectrum for the inner corona, 35 Fraunhofer lines between  $H\beta$  and  $H$  for the outer corona, and bright  $H$  and  $K$  lines extending entirely across the moon's disk, as well as  $40'$  east of the sun's limb. The latter indicates clearly that prominence radiation is diffused in the earth's atmosphere. The photographs of Mr. Peters, of the United States Naval Observatory, taken at Fort de Kock, Sumatra, confirm Perrine's results as to the formation of hoods or envelopes above some of the prominences, and are replete with structural detail. The corona, according to Perrine's photographic negatives, was polarized in the portions  $10'$  beyond the solar limb in all position angles including the polar regions. In negatives of the English astronomer, Newall, some of the streamers showed greater extension in the polarized than in the unpolarized light.

The spectroscopic results of this eclipse were not unimportant. Dr. Humphreys used a concave grating of 30 feet focal length without slit or lens and was able to present accurate wavelengths of nearly 400 lines in the chromosphere, assign their intensity and character, and identify the substance in most cases. Hydrogen, helium, and the  $H$  and  $K$  light, generally attributed to calcium, but by Trowbridge to oxygen, gave arcs showing a height  $34''$ , or greater than the solar diameter. Humphreys' investigations point to "a very extensive distribution of the elements in the chromosphere with no narrow separating boundaries producing distinct layers of any kind," and show that "in general the heavier and, only the heavier, Fraunhofer lines appear as bright lines in the flash, and that the relative intensities in the two cases are roughly comparable." Dr. S. A. Mitchell, using a Rowland flat grating of 15,000 lines per inch and a quartz lens, secured measures on some 480 bright lines for the flash at third contact. The theory of Sir Norman Lockyer that lines stronger in the spark than in the arc spectrum, known as "enhanced" lines, are found in the spectrum of the chromosphere, has been critically examined by Dr. Mitchell, by means of the spectroscopic data furnished by his photographs, and he concludes, "From these comparisons it would seem that there is no close connection between 'enhanced' lines and the bright lines of the chromosphere seen in the flash." In the special work on the corona contemplated by Professor Barnard's long exposure of a very large plate, and by Dr. Abbot's second attempt to measure the coronal heat bolometrically, there was universal interest among astronomers and universal regret at the compulsory postponement to a future eclipse on account of the clouds. A

photographic search for an intra-Mercurial planet was conducted by Perrine using four lenses covering a stretch of  $19^\circ$  on either side of the solar equator. The faintest stars on the plates range from 6.5 to 9.3 visual magnitude, and Perrine infers that "unless at the time of the eclipse the planetary bodies were directly in line with the sun or with the brightest portion of the corona, there is no planetary body as bright as 5.0 visual magnitude within  $18^\circ$  of the sun, whose orbit is not inclined more than  $7\frac{1}{4}^\circ$  to the plane of the sun's equator."

*Bibliography.*—The general theory of eclipses and the methods for their computation have been developed by Bessel in the 'Astronomische Nachrichten,' Nos. 151 and 152, but with the utmost rigor in his 'Astronomische Untersuchungen,' Vol. II.; and by Hansen in 'Astronomische Nachrichten,' Nos. 339–342, and in complete treatment in 'Abhandlungen der math., phys. Classe der Königlich Sächsischen Gesellschaft der Wissenschaften,' Vol. IV. The most reliable general tables for the computation of eclipses are those of Newcomb, 'Astronomical Papers of the American Ephemeris,' Vol. I. Oppolzer's 'Syzygientafeln für den Mond' (Publication der Astronomischen Gesellschaft, XVI.), and his 'Tafeln zur Berechnung der Mondesfinsternisse' (Denkschriften der K. Akademie der Wissenschaften zu Wien, Vol. XLVII.), are based on Hansen's 'Lunar Tables' and are employed in the production of that rich storehouse of eclipse knowledge: Oppolzer, 'Canon der Finsternisse,' published as Vol. LII. of the 'Denkschriften' of the Vienna Academy. It contains the elements of 8,000 solar and 5,200 lunar eclipses occurring between the dates —1207 Nov. 10 (Julian) and 2161 Nov. 17 (Gregorian), and the accompanying charts show the approximate path of each eclipse on the earth's surface. A valuable accessory to Oppolzer's 'Canon' is found in Dr. R. Schram's 'Tafeln zur Berechnung der näheren Umstände der Sonnenfinsternisse,' published in Vol. LI. of the Vienna 'Denkschriften.' Dr. Eduard Mahler, in Vol. XLIX. of the Vienna 'Denkschriften' has published valuable elements and tables entitled 'Die Centralen Sonnenfinsternisse des XX. Jahrhunderts.' Ginzel, in the 'Sitzungsberichte' of the Vienna Academy, LXXXV., LXXXVII., and LXXXIX., and in his 'Spezieller Canon der Finsternisse,' published by the Berlin Academy, has brought together a large array of references to ancient eclipses, and compared them with computation. The papers of Airy, Williams, Maguire, and S. J. Johnson in the 'Monthly Notices' of the Royal Astronomical Society are of interest. The physical data and problems of total solar eclipses are treated in a vast modern literature mostly issued by the observatories and learned societies. A highly important compend of physical information concerning total solar eclipses is that of Ranyard, 'Memoirs of the Royal Astronomical Society,' Vol. XLI. For the later eclipses the most valuable discussions are to be found in the publications of the United States Naval, Harvard, Lick, Yerkes, and Smithsonian observatories, in the 'Astronomische Nachrichten,' the 'Memoirs,' and the 'Monthly Notices' of the Royal Astronomical Society, and in the 'Astrophysical Journal.'

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## ECLIPTIC—ECSTASY

**Eclip'tic**, in astronomy, the sun's path, the great circle of the celestial sphere, in which the sun appears to describe his annual course from west to east. The Greeks observed that eclipses of the sun and moon took place near this circle; whence they called it the *ecliptic*. The sun does not always rise to the same height in the meridian, but seems to revolve round the earth in a spiral, and is in the equator twice a year, about 22 March and 22 September. The points of the equator at which the sun is stationary on these days are at the intersection of the equator with the ecliptic. On 21 June the sun reaches its greatest height in the heavens, and 21 December it descends the lowest. The ecliptic, like all circles, has two poles, which move about the poles of the earth every 24 hours, and in this manner describe the polar circles. What appears to be the path of the sun, however, is in reality the path of the earth. The planets and the moon revolve in different planes; but these are inclined at only a very small angle to the plane of the ecliptic; hence these bodies can be but a small distance from the ecliptic. The plane of the ecliptic is very important in theoretical astronomy, because the courses of all the other planets are projected upon it and reckoned by it. By the obliquity of the ecliptic we understand its inclination to the equator, or the angles formed by the planes of these two great circles. This angle is measured by the arc of a third great circle, drawn so as to intersect the two others perpendicularly, in the points at which they are farthest apart. The ancients endeavored to measure the obliquity of the ecliptic. According to Pliny, it was first determined by Anaximander; according to Gassendi, it had been ascertained by Thales. The most celebrated measurement of this obliquity in ancient times was made by Pytheas, at Marseilles. He found it, 350 B.C., to be  $23^{\circ} 40' 23''$ . A hundred years later, according to Ptolemy, Eratosthenes found it to be  $23^{\circ} 51' 20''$ . Various measurements have subsequently taken place, even down to our own time; and it is remarkable that almost every measurement makes the angle less than those which preceded it. See DAY; NUTATION.

**Eclogite**, ĕk'lō-jīt, or **Eklogite**, a crystalline rock composed of the grass-green amphibole called smaragdite, and red garnet. Another variety of eclogite is composed of omphacite, a grass-green granular variety of pyroxene, and garnet. Eclogite is not an abundant rock; it is usually associated with the older crystalline schists, but as a rule is not itself schistose. It is found in Norway, Greece and in parts of the German empire.

**Eclogue**, ĕk'lōg, in poetry, the name is given to poems of the same form; thus the satires of Horace were called eclogues. Since Virgil's *Bucolics* received this name (from grammarians probably, and not from the poet), the term eclogues has usually been applied to what Theocritus called *idyls*—short, highly finished poems, principally of a pastoral nature. See IDYL.

**Ecole des Beaux Arts**, ā-kōl dā bō-zār, (School of Fine Arts), the French government school in Paris, founded by Mazarin in 1648, and provided with an extensive staff of teachers. The competitions for the *grands prix de*

*Rome* take place at this school. All artists between the ages of 15 and 25, whether pupils of this school or not, may compete, after passing two preliminary examinations. The successful competitors receive an annual allowance from the state for three or four years, two of which must be passed at Rome.

**Ecology**. See BIONOMICS; PLANT GEOGRAPHY.

**Economic Association, American**, organized 1885 for the encouragement of economic research, the publication of economic monographs and the encouragement of perfect freedom of economic discussion.

**Economic Development of the United States**. See UNITED STATES—ECONOMIC DEVELOPMENT OF THE.

**Economic Entomology**. See ENTOMOLOGY, ECONOMIC.

**Economics**. See POLITICAL ECONOMY.

**Economists**, a name given to certain French writers of the 18th century, who maintained that agriculture is the only fountain of wealth, and therefore clamored for a land tax. Persons versed in the science of political economy, as Malthus, an English economist. Also applied to officers in some cathedrals in the Church of Ireland, who are appointed to manage the cathedral fund, to make payments, etc.

**Economy**, Pa., village in Beaver County, on the Ohio River, and Pittsburg, Ft. W. & C. R.R.; 20 miles northwest of Pittsburg. The first settlements were made by a colony of "Harmonists" who had formerly lived in Pennsylvania, then moved to Indiana, but returned and founded Economy in 1825. Pop. 1,062. See HARMONISTS.

**Ecrevisse**, ā-křev-ēs, **Peter**, a Flemish novelist: b. Obbicht, Limburg, 1804; d. 1879. In 1860 he withdrew from a promising political career and devoted himself to literature. He is noted for his power of description and his simple earnest style. Among his numerous historical novels may be mentioned: 'The Destruction of Maestricht'; 'The De Witt Brothers.' He was author also of some novels of society: 'The Cancer of Cities'; 'The Stepson'; 'The Servingman of Kempen.'

**Ecrévisse**. See CRAYFISH.

**Ec'stasy**, a state of consciousness, in which the natural powers or faculties are transcended by absorption in a fixed object or idea beyond normal cognition. In its theological aspect the term ecstasy is generally used as equivalent to rapture. Distinction should be made between true religious ecstasy and its simulations. Saint Thomas Aquinas, the great theologian of the Middle Ages, says that it may arise from three causes; first, bodily, as when a person is alienated from his senses by disease; secondly, it may be preternatural, as when it is wrought by the agency of devils; and lastly, and this is the case of true religious ecstasy, when it comes from the Spirit of God. Many instances of this latter are recorded in the Old and the New Testaments, and we also have accounts of this supernatural phenomenon in the lives of the Saints. Mystical writers describe this state as the complete suspension of the senses, the body being, as it were, dead, while the will, as Saint Teresa points out, retains its full power and is completely absorbed in God. Ec-

stasy arising from disease is described in the terms of modern science as a "condition of the nervous system and mind characterized by immobility, suspension of normal sensory and motor functions, and rapt concentration upon a limited group of ideas." There is little question but that ecstasy of this latter kind is a manifestation of the hysterical temperament. It is closely allied to hypnotism, catalepsy, trance, etc. Consult Maudsley, 'Pathology of Mind'; Tuke, 'Dictionary of Psychology'; Janet, 'Mental State of Hystericals'; Baldwin, 'Dictionary of Philosophy and Psychology' (1901); Mantegazza, 'Estasi Umane' (1887); James, 'Varieties of Religious Experience' (1902).

**Ecthyma**, êk-thî'ma, a complication of a number of general disorders manifesting itself as a form of pustular inflammation of the skin, particularly distributed on the extremities, the lower especially, the neck and trunk also often being affected. As a rule the affection begins as a small pimple which takes a rounded outline unless scratched. This pimple develops into an ulcer which is covered over with a thick dark crust. The ulcer heals slowly and there is a small scar resulting. The development of the disease is slow, usually running a fortnight, and the pimple may be single or appear in crops. There is burning and pain. The common cause of ecthyma is diminished bodily resistance, such as is found in starvation or in syphilis, tuberculosis, diabetes or anæmia. The common organisms causing the actual pustulation are streptococcus and staphylococcus. The initial injury is often brought about by scratching due to the bites of some house-pests, or the itching of diabetes, or senile itching, or some form of local skin irritation. Soap and water, good food, and antiseptic dressings, such as hydrogen peroxide, nitrate of silver, and sulphur ointment, are usually sufficient, with proper general hygiene, to bring about a cure.

**Ec'toderm.** See EMBRYOLOGY.

**Ecto'zo'a**, animals parasitic on the outside of living bodies, as distinguished from *Entozoa*, animals parasitic within them. Both terms are general and have no taxonomic significance.

**Ectro'pion**, or **Ectropium**, a Greek term meaning an everted eyelid, a turning outward; an abnormal eversion of the eyelids.

**Ecuador** (properly, *La República del Ecuador*: The Republic of the Equator), a country of South America. According to the claims of its own government, it is bounded on the east by Brazil, extending from the Pacific Ocean, at lon. 82° 55' W., to lon. 72° 12' W., and from lat. 1° 50' N. to lat. 5° 30' S., but nearly all of the region east of the Andes is claimed by Peru, and the boundary with Colombia is also in dispute (see COLOMBIA). Therefore, it is bounded on the north and northeast by Colombia, and on the southeast and south by Peru, according to the adverse views entertained by those competing governments. The area in its actual possession is about 120,000 square miles; the total area, if we include disputed territory and the archipelago of Galápagos, is nearly 276,000 square miles.

**Political Divisions.**—The country is divided into 16 provinces (counting as one the undefined eastern region), as follows: (1) Province of Pichincha, including the *cantones* of Quito, Cay-

ambe, and Mejia. Its chief town, also capital of the republic, is Quito, with 80,000 inhabitants: seat of the central government, the archbishopric, the university, the supreme and superior courts, etc. (see below, *Judiciary*), headquarters of army corps, general commanding district, and superintendent of police. Quito's principal buildings and institutions are: The palaces of the president, of the archbishop, of the government, of the School of Arts and Trades, and of justice; city hall, university, three seminaries, astronomical observatory, Institute of Sciences, Medical School, two chemical laboratories, two museums of natural history, two botanical gardens, 33 churches with convents, six additional convents, four colleges, three schools for young women (116 schools in the canton), five public libraries, six asylums, two houses of refuge, two houses of correction, five cemeteries, four barracks and an arsenal, two public promenades, five squares with statues, the Sucre Theatre (which holds 2,000 spectators), and two banks. There are 16 journals. Industries of the province are: cattle- and sheep-raising, manufacture of cloth, candles, cheese, chocolate, etc. There are 22 mills. The embroideries and laces made by the women of Quito are famous. The city, built on the flank of the mountain which gives its name to the province, has beautiful suburbs: thanks to its elevation above sea-level (9,250 feet), the climate is temperate. The Alameda is a fine park, planted with oaks, eucalyptus, and other large trees. (2) The province of Carchi: principal town Tulcan (5,000 inhabitants), residence of the governor, police commissioner, commander of the military force of province, and municipal authorities. Industries are: cattle-raising and the cultivation of cereals in the higher and middle (temperate) regions. The products of the lowlands are sub-tropical—sugarcane, etc. (3) The province of Imbabura. Its chief town, Ibarra, which was destroyed by the earthquake of 1808, has now 5,000 inhabitants. It is the residence of a bishop, in addition to the civil and military authorities located in every province—those mentioned under Carchi. Principal buildings are the palace of the government, Roman Catholic schools, churches, and convents. Products of the region are cereals, sugarcane, cotton, and cattle. (4) Province of Léon: its principal town, Latacunga, has 12,000 inhabitants. Products are as given in 2 and 3; there are also potteries. The highest active volcano in the world, Cotopaxi (19,614 feet) is in this province. (5) Province of Tungurahua: the principal town, Ambato, has a population of 8,000. Special products of the region are wine, porcelain, and hats. It includes the Tungurahua volcano. (6) Province of Chimborazo, with five *cantones*. The principal town, Riobamba, which was destroyed by an earthquake in 1799, has 12,000 inhabitants. A leading product is cinchona, or Peruvian bark. The mountain which gives its name to this province is often called "the king of the Andes," though it is not equal to the highest peaks in Bolivia. (7) Province of Bolívar, a salt-producing region; chief town Guaranda (6,000). (8) Province of Cañar, with gold-mining as one of its industries; principal town Azogues (4,000). Ruins of a palace dating from the period of Inca supremacy are found in this province. (9) Province of Azuay: its principal city, Cuenca (q.v.), with 30,000 inhabitants, is a centre of literary

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and artistic life in the republic. (10) Province of Loja: its principal town, also called Loja, has 10,000 inhabitants. This province adjoins Peru, and its boundary with that country is disputed. It contains the ruins of the palace of Villamarca. (11) Province of El Oro, which has gold mines at Zaruma, and produces cacao and coffee on the lands along the Pacific coast. There are also fisheries. Chief town Machala, with 3,200 inhabitants. (12) Province of El Guayas, of which Guayaquil (pop. 60,000) is the commercial metropolis. The local authorities are: the governor, bishop, municipal council, general commanding the troops of the district, chief of police, justices of the superior court and judge of commerce, the consular corps, and the superintendent of the custom-house. Noteworthy buildings or institutions are: the city hall, palaces of the governor, bishop, and commanding general, cathedral, seminary, nine churches, several chapels, municipal library, civil and military hospitals, schools of medicine and law, university, chemical laboratory, national college, a ladies' philanthropic society, a school of arts and crafts, Convent of the Sacred Heart School for Young Women, orphan asylum, Olmedo Theatre, circus, etc. There is a statue of the poet Olmedo in the avenue which bears his name, and an equestrian statue of Bolivar in Seminario Park. A dozen newspapers are published in the city. Products of the region are: cacao, coffee, sugarcane, cereals, cotton, rubber, vegetable ivory or corozo, construction and cabinet woods, articles manufactured with sugar, tropical fruits, cattle, horses and mules, tobacco, beer, artificial ice, and mineral waters, chocolate, liquors, alcohol, soap, candles, hats, hammocks, and several varieties of fish. There are two banks of issue and a savings bank, four clubs and German and Spanish casinos. Guayaquil was partly destroyed by fire in 1896, but has been rebuilt. It has improved in appearance, and perhaps also in the matter of sanitation; yet it has not a good reputation for healthfulness. The climate is very hot. The city is lighted by gas, and has potable water, the source of supply being in the cordillera. (13) Province of Los Rios: its chief town, Babahoyo, has 3,000 inhabitants. (14) Province of Manabi; principal towns Portoviejo (5,000) and Jipijapa (6,000). The finest of the so-called "Panama" hats are made exclusively in Ecuador, especially in Jipijapa. Other products of this region are sarsaparilla, vanilla, and pearls from a small island. (15) Province of Esmeraldas, where tobacco is grown that is comparable with the Cuban product. Population of the chief town, also called Esmeraldas, about 6,000. (16) The vast, insufficiently explored Oriental province, with settlements at Napo, Archidona, Tena, and Canelos, and Indian tribes, the Jibaros, etc. A governor and chief of police represent the authority of the republic. Chapels have been built, and missions established. The soil is supposed to be uncommonly fertile, and it is watered by large rivers. (17) Galápagos Archipelago (q.v.), now called the Archipelago of Colón by some Ecuadorian writers who wish to create the impression that it is an attractive field for immigration. It was formerly a penal settlement, and was especially used as a place of banishment for political offenders. The population of Chatham Island was said to be about 2,000 in 1900; the other islands are nearly uninhabited. The authorities

are the territorial governor, a priest, and a military commander. Products: the giant tortoises (Spanish, *galápagos*), whalebone, etc.

**Topography and Physical Geography.**—The cordilleras of the Andes traverse Ecuador, running nearly north and south, with elevated plains between the eastern and western mountains—some of the latter forming a sequence that has suggested to geographers two parallel chains; and it is, indeed, true that the eastern and western limits of the broad band of Ecuadorian upland roughly parallel each other. (See CORDILLERAS.) There are four facts of special interest: First, Though we do not find here the highest single peaks in the world, or even in South America, there are nowhere else so many peaks of very great height, forming a group. Second, their equatorial situation gives to these masses of granite, gneiss, schist, trachyte, porphyry, and volcanic detritus wholly exceptional contrasts in temperature (see below, *Climate*). Third, this region has been in the past, and is probably today, more subject to volcanic disturbances than any other in South America. Fourth, as an offset to the group of high peaks, the Andean ridges sink downward, forming the lowest pass that exists at any point between Colombia and the southern end of the continent. The principal rivers of the lowlands of western Ecuador, running from the central region of mountains and high plains to the Pacific, are the Guayas and the Esmeralda. The former empties into the Gulf of Guayaquil, one of the best harbors on the western coast of South America. In the eastern lowlands, the Napo and its tributaries belong to the Amazon River-system.

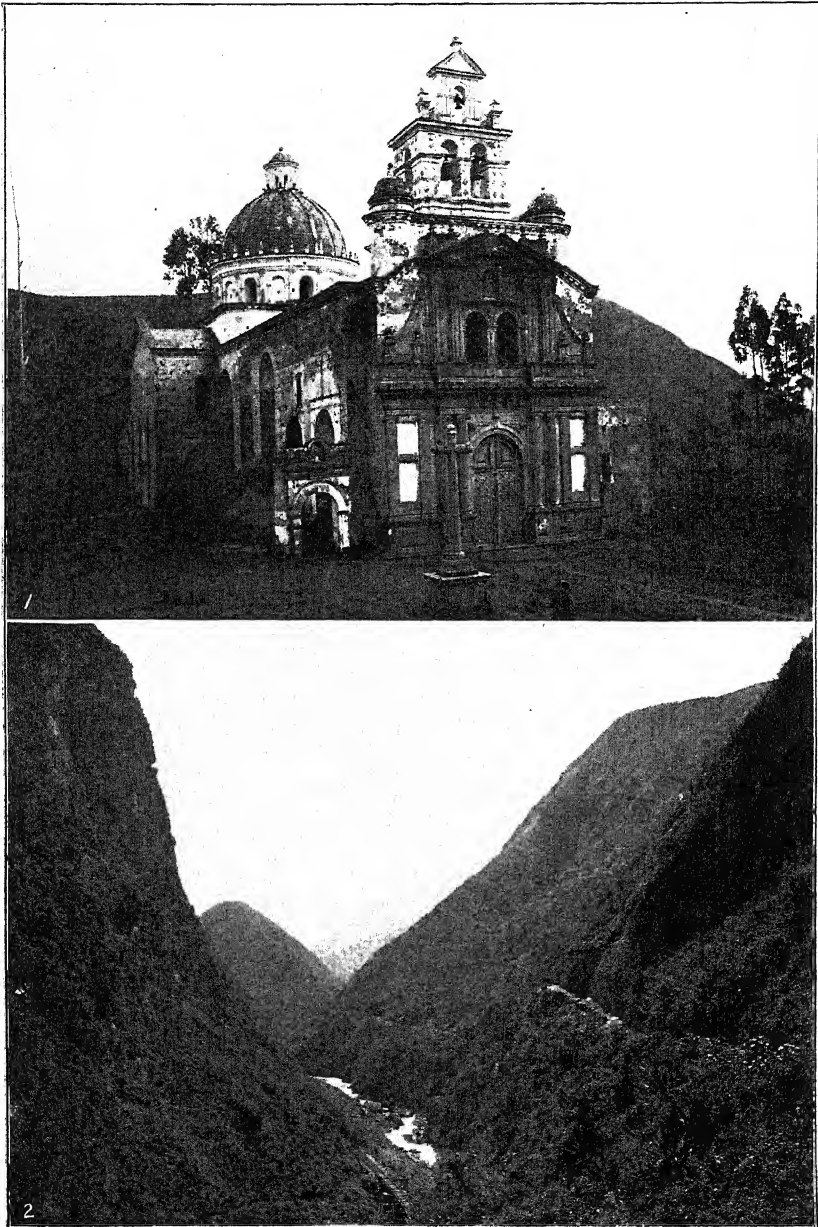
**Mineral Resources.**—Salt, mineral pitch, and gold are produced. The Zaruma mines, province of El Oro, were reported as being worked on an extensive scale in 1903. That district contains numerous gold-bearing quartz veins, which were worked by the Spaniards 100 years ago.

**Climate.**—The mean temperature of the coast at Guayaquil, etc., is 28° C.; that of the interior ranges from 35° C. in the lower valleys to 18° or even 10° C. on the plateaus, according to the altitude. The lower slopes of the mountains are torrid; the highest crests are snow-clad. The climate of the capital is temperate and spring-like throughout the year, with little variation, and it is said to be one of the best in the world for the cure of tuberculosis. (See also CUENCA.) There are two seasons only, the rainy and the dry.

**Agriculture.**—The cultivated area is limited, owing to the lack of laborers; nevertheless Ecuador produces more cacao than any other country, and not a little coffee. These products, with sugarcane and tobacco, are found in the lowlands of the coast and Amazon basin; cereals and vineyards in the elevated valleys. (See also *Political Divisions* for products of the different provinces.)

**Exports and Imports.**—In 1901 the total value of exports was 16,392,333 *sucre*s, and the total value of imports for the year 15,126,281 *sucre*s (value of *sucre*, \$0.487). On the import list of the country the United States ranks first, Great Britain second, and Germany third. Imports from the United States in the fiscal year 1901 were valued at \$2,015,085; exports to the United States \$1,424,840. Shipments of cacao from Ecuador in 1901 amounted to 23,179,095 kilograms, showing a marked increase over those

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1. Old Church at Quito.

2. A Pass in the Andes; Guayaquil and Quito Railway.



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of 1900. Ecuador exported in 1900 through the port of Guayaquil 1,733 tons of coffee, with a value of \$121,500. Imports are: cloth (cotton, woolen, silk), foodstuffs, boots and shoes, oils, alcohol, wines and liquors, beer, mineral waters, preserved and fresh fruits, and live-stock.

*Railways, etc.*—Sixty miles of the railway from Guayaquil to Quito were built before 1880, that is, from the coast to the village of Chimbo, at the base of the cordillera. There the enterprise was checked by the difficulties of construction. A company organized in the United States undertook to complete the road, and by 1903 had succeeded in laying rails from Chimbo to Guamote, on the plateau, a distance of 58 miles. There are 1,221 miles of telegraph, with 50 offices. The Ecuadorian landing-station of the Central and South American Telegraph Company's cable is at Salinas, which was declared open as a minor port by executive decree 21 Aug. 1902. Quito and Guayaquil have telephone services; the latter a street-car system. The mails are carried twice a week to all parts of the republic; to foreign countries once a week. Twenty passenger steamers ply on the Guayas River, and between Guayaquil and the other coast towns. English steamships of the Pacific line, and vessels of the Chilean line plying between Valparaíso and Panamá call regularly at Guayaquil.

*Banks.*—(At Guayaquil and Quito: see *Political Divisions*.)

*Government.*—Congress meets at Quito every two years, usually on 10 Aug., for 60 days. There are two chambers: the senate (two senators from each province; term, four years) and the chamber of deputies (one deputy for each 30,000 inhabitants; term, two years). Both senators and deputies are elected by direct popular vote. Eleven constitutions have been promulgated since 1830; that of 12 Jan. 1897 is now in force. The president and vice-president of the republic are elected for four years by direct vote of the people; they cannot be re-elected until eight years have passed after expiration of their terms of office. The president cannot go out of the country, either during the continuance of his functions or for a year after they have ceased. There were formerly five ministries, but the number has been reduced to four, namely, those of the interior, police, and public works; foreign relations, public instruction, justice, and worship; finance; and war and navy. The council of state is a body composed of the vice-president of the republic, the ministers, two officials of the law courts, the rector of the university, two senators, two deputies, and two citizens not holding other office. Governors of provinces are agents of the executive, appointed by the president; agents of the governors are the "political chiefs"; and agents of the latter are "political lieutenants," one for each parish, who have the rural authorities under their charge.

*Finances.*—The budget for 1902 showed the following sources of revenue for the government: customs 9,640,700 *sucre*s (the chief items being, duties on imports with surtax 6,400,000, and duties on exports with surtax 1,800,000 *sucre*s); receipts from industries controlled by the government, that is, salt and powder, 450,000 *sucre*s; sundry taxes 2,868,804.25; public lands, etc., 423,000 *sucre*s; and leases 30,000 *sucre*s. Disbursements were: congress 111,780 *sucre*s; the president of the republic 43,632 *sucre*s; the

vice-president 9,600 *sucre*s; council of state 1,500 *sucre*s; department of interior, police, and public works 3,603,168 *sucre*s; department of foreign relations, etc., 2,168,034 *sucre*s; department of finance 2,821,694.32; department of war and navy 3,691,502.18; additional public works 1,068,802.80 *sucre*s. Total disbursements 13,319,764.30; surplus 98,739.95 *sucre*s. The foreign debt, chiefly a relic of loans contracted by the old republic of Colombia, at the time of the union of Ecuador, Venezuela, and New Granada, was approximately \$3,355,000 in 1901; the internal debt is much larger. The gold standard has been adopted in accordance with the law of 4 Nov. 1898.

*Army and Navy.*—In time of peace, the army consists of: infantry, about 3,690 men; artillery, 1,362; cavalry, 468; national guard (on paper), 95,329. The national guard includes companies of firemen—organizations which are especially numerous and influential in Guayaquil. The naval vessels are, one torpedo boat and a transport.

*Population.*—The boundaries of the republic being in dispute, and a large part of Ecuador's claim being unexplored territory, estimates of the total number of inhabitants vary, naturally. The Ecuadorians usually say about 1,500,000, including uncivilized Indians.

*Education.*—Primary instruction is gratuitous and obligatory for children between 6 and 12 years of age. Among the subjects taught, beside the familiar elementary branches, are morality and religion, and urbanity. In the boys' schools the constitution of Ecuador is added; in those for girls, sewing and domestic economy. In 1900 there were more than 80,000 pupils in the public schools, as compared with 47,913 in 1885. The number of schools increased from 789 in 1885 to nearly 1,250 in 1903. Secondary instruction is provided in 37 "colleges," with 371 professors and 4,500 students; the school year beginning 10 October and ending 30 July. The university at Quito—with associate universities at Cuenca and Guayaquil, has faculties of philosophy, belles-lettres, law, medicine, physical and natural sciences, mathematics, and agriculture. An officially authorized publication states that "a large number of primary and secondary schools have been confined hitherto [before 1900] to the religious orders, who have acquitted themselves of their task with zeal and success." Schools of arts and crafts are found in the provinces of Pichincha, León, Chimborazo, Azuay, Loja, and Guayas. Bahia has a commercial school.

*Literature.*—José Joaquín de Olmedo (b. Guayaquil 1780) and Juan Montalvo (b. Ambato 1833) are esteemed by loyal Ecuadorians, the former the greatest poet, the latter the greatest prose writer, of South America. Ecuador was also the birthplace of José Mejía, the "American Mirabeau," and of many historians, theologians, poets, romancers, and critics whose works are as highly regarded in Spain as in America. The Ecuadorian Academy (founded 1875) is the chief of the literary associations of the republic. Liberty of the press is guaranteed by the constitution. In painting and music the progress is less noteworthy.

*Judiciary.*—Ecuador's courts are: the supreme court, at Quito (five justices, attorney-general, two secretaries); superior courts at Quito, Guayaquil, Cuenca, Riobamba, Loja, and



Portoviejo; court of account, at Quito (seven judges); municipal civil tribunals of the first instance at Quito, Guayaquil, and Cuenca; fiscal judges for each province; judges of commerce in large towns; judges of mines, police, and parishes. In criminal cases, trial by jury is provided for, but only in the larger towns.

*Local Government.*—This is controlled, as we have shown, by the central government. Chief towns of *cantones* have municipal councils, commonly of five members. There are rural (mounted) and urban police, with a director or chief in each provincial capital.

*History.*—The Quito Indians, who held the country near the present capital, were conquered, perhaps in the 10th century, by a more warlike race led by chiefs called Scyris. These in turn yielded to the Incas of Peru. On the death of Inca Huayna-Capac, the empire was divided between his two sons, Atahualpa and Huascar. The former, whose mother was a Scyri princess, revived the Quito kingdom; Cuzco and the southern empire were given to the latter. War broke out between the brothers shortly before the Spaniards under Francisco Pizarro arrived upon the scene, and this civil strife made possible the conquest of a great nation by a handful of adventurers (see Cuzco and PERU). Benalcazar, the famous Spanish captain, completed the conquest of the Scyri kingdom, and seized the city of Quito (1534). Between 1564 and 1820 this region was administered as a presidency; and 36 presidents exercised authority there as representatives of Spain before the series of "presidents of the republic" began. Quito's first demonstration in favor of independence, 10 Aug. 1809, was quickly and savagely repressed; Guayaquil was more fortunate in her belated attempt (9 Oct. 1820). A campaign which resulted in the capture of Quito, after the battle of Pichincha, was organized by a triumvirate whose members were the poet José Joaquín de Olmedo, mentioned above, the merchant, F. Roca, and the soldier, Rafael Jimena. The battle of Pichincha was won for the patriots by the Venezuelan general, Antonio de Sucre, Bolívar's lieutenant: the territory thus liberated was naturally drawn into the Colombian federation, which Bolívar dominated for a time (see COLOMBIA). In 1830, after the dissolution of that greater Colombia, Ecuador was constituted as an independent republic. The convention of Riobamba placed Gen. Juan José Flores at the head of the government. His successor (1835-9) was Vicente. Flores was again in power from 1839 to 1845, and, with the approval of many partisans, tried to secure a much longer term and dictatorial powers. A second triumvirate, composed of Olmedo, Roca, and Noboa, carried on the government until a convention was held at Cuenca. This convention elected Vicente Ramón Roca, who served as president from 1845 to 1849. Vice-President Acásubi assumed the presidency when congress and the country could not agree upon a candidate; the country, however, continued to be disturbed until 1851, when Diego Noboa was chosen by a constituent assembly. In the following year he was displaced by Gen. José María Urbina, at the head of a successful revolution. Urbina was president until 1856. Slavery was abolished during his term. Gen. Francisco Robles followed (1856-9). During the next two years the country had a varied experience:

war with Peru, the dictatorship of Gen. Franco, and the provisional government of Gabriel García Moreno. The convention of Quito elected García Moreno to the presidency (1861-5). Jerónimo Corrión, elected in 1865, retired in 1867. Javier Espinosa served from 1868 to 1869. García Moreno, as the leader of an insurrection, took office again (1869-73), and in 1873 secured re-election by the use of force. He was assassinated 6 Aug. 1875. Antonio Borrero, his successor, was driven from office by Gen. Ignacio de Veintemilla in 1876. After the expiration of the legal period, President Veintemilla made himself dictator. José María Plácido Caamaño was president from 1884 to 1888; Antonio Flores from 1888 to 1892; Luis Cordero from 1892 to 1895—when he resigned to put an end to bloodshed. Gen. Eloy Alfaro, at first "supreme chief," was legally elected in 1897. Gen. Leonidas Plaza succeeded him in 1901.

*Bibliography.*—American Republics, International Bureau of the, 'Monthly Bulletin,' Washington, 1902-3; Cevallos, 'Geografía del Ecuador' and 'Resumen de la historia de Ecuador'; Church, 'Ecuador in 1881: Report to United States Government'; Prescott, 'Conquest of Peru'; 'République de l'Equateur et sa participation à l'Exposition Universelle de 1900'; Velasco, 'Historia del Reyno de Quito' (3 vols. Quito 1841-4), and a French translation of that work in H. Ternaux Compans' 'Voyages, Relations, et Mémoires Originaux.'

MARRION WILCOX.

*Eczema*, čk'zě-ma, an acute or chronic disease of the skin, showing a vast variety of changes in the skin itself, and accompanied by intense itching, burning, or pain. The changes in the skin at first are usually marked by redness, papules, then small vesicles or pustules which later become crusted and dry; or the surface is weeping. Infiltrated and scaly patches are common. All of the different forms of eczema (and no less than a dozen varieties are described by skin specialists) have certain definite changes occurring in the skin. There is usually swelling, congestion, and increase of temperature locally. There is almost invariably an exudation of fluid into the tissues, with the formation of vesicles and pustules, as described. There is further a certain amount of plastic exudation which produces in the skin papulous areas that are thickened and infiltrated. Finally there are the subjective symptoms of itching, which may be only a slight tingling or prickling sensation, or may be so intense as to demand continued and deep scratching, until bleeding or oozing takes place. This itching is, as a rule, intermittent in character, being almost invariably worse at night when the patient is covered, the heat of the body causing the aggravation. Sometimes exposure to cold brings about intense itching. The disease usually runs an acute course, and may be limited to one region of the body, or may be general. Its general tendency is to progress rather than to get well. It is perhaps one of the most obstinate of all skin diseases, and at the same time one of the most difficult to diagnose and to treat. The treatment of each case is a particular study. Sometimes the disease is beyond the power of the best skin specialist. At other times corrections of minute errors in diet will bring about cure. So far as household remedies are

concerned, only those that can relieve the itching are deserving of notice in this place. One of the best of these is carbolic acid in weak solution—two to three per cent. This may be applied on a bit of absorbent gauze. Special care being taken not to enclose a particular part completely with the weak carbolic acid. Bland non-irritating powders such as calamine and oxide of zinc are often useful. When the disease becomes chronic it is apt to be extremely obstinate.

**Edam**, ɛ'dām, Holland, town 12 miles north-northeast of Amsterdam, and about a mile from the western shore of the Zuyder-Zee, with which it is connected by a canal. This place is chiefly noted for its trade in cheese, of which nearly 1,000,000 pounds are annually sold in its market. (See CHEESE.) The town was once fortified, and has still a wall with seven gates. Pop. 6,444.

**Edar**, India, a Rajput state of Guzerat in the Mahi Kantha agency, tributary to the Guicowar of Baroda, and subject to the political superintendence of the presidency of Bombay. It has an area of about 4,966 square miles, and an estimated population of 260,000. Its capital, a picturesque town of the same name, contains 6,300 inhabitants.

**Edda**, ɛd'a (Icel. meaning "grandmother"), a name given by Bishop Brynjulf Sveinsson to a volume containing the system of old Scandinavian mythology, as being the mother or source of all Scandinavian poetry. It was originally compiled by Sæmund, a Christian priest in Iceland, who died 1133, and contained poems and chants of a mythic, prophetic, and religious character. A prose synopsis of these poems was made by Snorri Sturleson, an Icelander (b. 1178), a pupil of the grandson of Sæmund, who was court poet in Norway. He was assassinated in 1241, on his return to Iceland. The portion of the book compiled by Sæmund is known as the 'Elder' or 'Poetic Edda,' and the continuation of Sturleson as the 'Younger' or 'Prose Edda.' Translations of both books are found in English, German and French. See ICELAND.

**Eddoes**, ɛd'ōz, a tropical vegetable. See COCCO.

**Eddy, Clarence**, American organist: b. Greenfield, Mass., 23 June 1851. He studied with Haupt in Berlin 1871, and between 1877 and 1879 gave a series of organ recitals numbering 100, without repetitions, in Hershey Music Hall, Chicago, in which city he resided for many years. He made successful tours through Europe, and in 1895 removed to Paris. In 1899 he was appointed director of music at the Paris Exposition of 1900.

**Eddy, Henry Turner**, American educator: b. Stoughton, Mass., 9 June 1844. He was graduated at Yale College in 1867. He was assistant professor of mathematics and civil engineering in Cornell University 1869-73; professor of mathematics, astronomy and civil engineering in the University of Cincinnati 1874-90; president of the Rose Polytechnic Institute, Terre Haute, Ind., 1891-4; in the last-named year accepting the chair of engineering and mechanics in the University of Minnesota. His publica-

tions include: 'Analytical Geometry' (1874); 'Researches in Graphic Statics' (1878); 'Thermodynamics' (1879); 'New Constructions in Graphic Statics' (1880, in German); 'Maximum Stresses Under Concentrated Loads,' etc.

**Eddy, Mary Baker Glover**: b. Bow, N. H. The world's highest meed of praise is eventually bestowed upon those who have made the largest contribution to its spiritual good, and it is in the light of this fact that the honored place of Mrs. Eddy's name, in the annals of the race, is unqualifiedly assured. The prominence in public thought which she has already attained, as the Discoverer and Founder of Christian Science, and the tender love which glows for her upon the altars of unnumbered hearts, find their explanation in the ministry of good which she has brought to her fellowmen.

Born in the town of Bow, N. H., her youth was spent in sympathetic touch with that picturesque beauty of nature for which the region is famed. Mrs. Eddy's great-grandfather, Captain Joseph Baker, was a man of honored reputation and bore a commission conferred by the Provincial Assembly. Her father and grandfathers were sturdy husbandmen who served God and their country as best they knew, and fostered in their children the elements of a noble character. The intellectual tastes and assertive strength of her father, and the piety and loving winsomeness of her mother, were united in her nature, and one who knew her intimately in her girlhood has spoken of her as being distinguished even then for "her superior ability and scholarship, her depth and independence of thought, and her spiritual-mindedness," all of which were but prophecies of her character, her ministry, and eminence as a religious leader.

She was a student of Sanbornton Academy, and later pursued her studies under Prof. Dyer H. Sanborn, and her brother Albert, who was a gifted and scholarly man. At 16 her fertile pen, as well as her ceaseless inquiry and investigation, began to disclose that impelling and insatiable instinct of the poet and truth-seeker which in later years was to achieve such beneficent and far-reaching results. In all the years which were revealing to her the vanity and unsatisfactoriness of earthly hopes, she was seeking, in the quiet cloisters of spiritual aspiration, for that revelation of truth which would bring her heart assurance and peace. Unaccompanied save by patient and unflinching faith, she followed that ascending path which leads from the plane of common experience to the higher levels of spiritual apprehension, and in an hour of hopeless physical suffering she reached such a realization of the present healing potency of the Master's word that she was immediately made whole. Mrs. Eddy's life since this epoch-making experience and discovery in 1866 has been devoted to that interpretation of the teaching of Jesus, and the practical application of its saving truths to human need, which she has denominated Christian Science.

Her great work, 'Science and Health with Key to the Scriptures,' was published in 1875, and has now reached its 280th edition. This is the text-book of Christian Science, embodying not only its teaching, but the practical rules by which every sincere inquirer may avail himself of its benefits. She has written and published many other works relating to Christian

Science, including 'Miscellaneous Writings,' 471 pp.; 'Retrospection and Introspection,' 120 pp.; 'Pulpit and Press,' 132 pp.; 'Unity of Good,' 80 pp.; 'Rudimental Divine Science,' 35 pp.; 'No and Yes,' 55 pp., and many other pamphlets, poems, annual messages to the Mother Church, etc. She has organized and conducted the movement, established its periodicals and educational system, and as leader, lecturer, teacher, editor and counselor has accomplished a work whose magnitude, substantiality, and success are a marvel to men.

The First Church of Christ, Scientist, the "Mother Church," in Boston, Mass., was chartered in 1879, and the church edifice was completed in 1895. Its present membership is about 28,000. Seven hundred and sixty-five Christian Science churches and societies, many of them provided with splendid church edifices, are now found in America, England, and other countries.

Mrs. Eddy has ever been known as a very generous and public-spirited woman. Her public and private benevolences have been large, amounting to hundreds of thousands of dollars. She recently gave \$100,000 toward the erection of an adequate Christian Science church in her native town.

Beloved and honored by all who know her, Mrs. Eddy lives in modest retirement at her country home in Concord, N. H., where, with unabated vigor and untiring devotion, she continues to direct that beneficent movement with which her name will ever be associated.

JOHN BUCKLEY WILLIS,

2nd Ed. C. S. Publications, Boston, Mass.

**Eddy, Richard**, American Universalist clergyman: b. Providence, R. I., 21 June 1828. During the Civil War he served as chaplain of the 60th New York Volunteers 1861-3. In 1877 he was made the president of the Universalist Historical Society, which office he still holds. He was editor of 'The Universalist Quarterly Review' (1884-91) and of the 'Universalist Register' since 1887, and is a prominent prohibitionist. He has published: 'History of Sixtieth New York State Volunteers' (1864); 'History of Universalism in America 1836-86' (1884-6); 'Alcohol in History' (1887); 'Alcohol in Society' (1888); 'Universalism in Gloucester, Mass.' (1892); 'History of Universalism A.D. 120-1890' in American Church History series (1894); and 'Life of Thomas J. Sawyer, D.D., and Caroline M. Sawyer' (1900).

**Eddy, Thomas**, American philanthropist: b. Philadelphia, Pa., 5 Sept. 1758; d. New York 16 Sept. 1827. He entered the insurance business in 1790, in which he made a large fortune. With Philip Schuyler and Ambrose Spencer he presented a bill for establishing a penitentiary system in 1796, which was passed. He had charge of erecting the first building and for four years was its director. In 1793 he was appointed by the Society of Friends to visit the Indians in New York State; was one of the governors of the New York Hospital; and in 1815 one of the founders of the Bloomingdale Insane Asylum. He was also one of the originators of the New York Savings Bank and the New York Bible Society, and a conspicuous promoter of the Erie Canal. He received the title of the "American Howard" for these labors, and in 1801 published 'State Prison of New York.'

**Eddy, Thomas Mears**, American clergyman: b. Newton, Hamilton County, Ohio, 7 Sept. 1823; d. New York 7 Oct. 1874. He studied in the classical seminary of Greensboro, Ind., and joined the Indiana Methodist conference in 1842. He was editor of the 'North-western Christian Advocate' from 1856 to 1868; served as pastor in Baltimore for three years; was appointed to the Metropolitan church in Washington, D. C., in 1872, and in the same year he was elected corresponding secretary of the Methodist Missionary Society. He was eminent as a journalist and was an author of no mean ability. Among his works was a 'History of Illinois during the Civil War' (2 vols. 1865).

**Eddy Currents** are short local currents set up in the iron masses of dynamo electric machinery; according to the law of Lenz they absorb a part of the energy expended in running the machine. The usual way of preventing them is to construct the parts affected, namely, the pole pieces and the armature cores, of laminæ built up so that the mass of the iron is divided by planes in a direction perpendicular to the direction of the electromotive forces tending to start the eddies.

**Eddystone Lighthouse.** The frequent shipwrecks on Eddystone rocks off the coast of Cornwall, England, led to the erection of a lighthouse on them by Henry Winstanley in 1696-1700. It was a wooden polygon, 100 feet high, with a stone base; but the great storm of 20 Nov. 1703, completely washed it away, with the architect. Another lighthouse was built in 1706-9, also of wood, with a stone base, and 92 feet high, by Mr. Rudyerd, a silk-mercator. This erection was burned in 1755. The next, noted for its strength and the engineering skill displayed in it, was constructed by Smeaton in 1757-9, on the model, it is said, of the trunk of the oak tree. It was built of blocks, generally one to two tons weight, of Portland oolite, encased in granite. The granite was dovetailed into the solid rock, and each block into its neighbors. The tower, 85 feet high, had a diameter of 26¾ feet at the base and 15 feet at the top. The light, 72 feet above the water, was visible at a distance of 13 miles. As the rock on which this tower was built became undermined and greatly weakened by the action of the waves, the foundation of another was laid on a different part of the reef in 1879. The new lighthouse, completed in 1882 by Sir James N. Douglass, is, like its predecessor, ingeniously dovetailed throughout. Its dioptric apparatus gives, at an elevation of 133 feet, a light equal to 159,600 candles, and visible in clear weather to a distance of 17½ miles. See EDDYSTONE ROCKS; LIGHT-HOUSE.

**Eddystone Rocks**, well known to seamen who navigate the English Channel, consisting of three principal ridges, and extending 600 or 700 yards in length. They lie nearly in the fair way from the Start to the Lizard, and are therefore an object of the utmost importance to mariners. On the summit of the largest rock a lighthouse has been erected, to serve as a beacon or signal to avoid the danger, as they are covered at the flood tide, but become dry at the ebb. It is situated 15 miles south-southwest of Plymouth, 45 east of Lizard Point; lon. 4° 16' W.; lat. 50° 10' 54" N. The swell at these

rocks is tremendous. After a storm, when the sea is to all appearance quite smooth, and its surface unruffled by the slightest breeze, the ground-swell or under-current, meeting the slope of the rocks, often causes the sea to rise above the lighthouse in a magnificent manner, overtopping it as with a canopy of foam. See EDDYSTONE LIGHTHOUSE.

**Edelfelt**, ä'dël-fêlt, Al'bert Gus'tav A'ristid, Finnish painter: b. Helsingfors, Finland, 21 July 1854. He began his artistic studies at Antwerp and afterward became a pupil of Gérôme, in Paris, where he developed a high skill in draughtsmanship, in the department of genre and portrait painting. He gained a second medal in the Paris Salon of 1882, and a medal of honor in the Paris Exposition of 1889. Two of his pictures have been purchased by the French nation for the Luxembourg.

**Edelinck**, ä'dêl-înk, Gerard, Flemish engraver: b. Antwerp 20 Oct. 1649; d. Paris 2 April 1707. He was patronized by Louis XIV., and produced over 420 plates.

**Edelweiss**, êd'êl-wîs; Ger. ä'dêl-vîs ("Noble-white"; *Gnaphalium* or *Leontopodium alpinum*), a perennial plant of the order *Compositæ*, growing at great altitudes in the Alps, the Pyrenees, and also in parts of Austria and Siberia. Its flower is white and somewhat star-shaped, the heads surrounded with a characteristic woolly involucre, and its leaves also having the same woolly character. It is comparatively scarce; generally grows in inaccessible positions; is eagerly sought by Alpine tourists, and has become so rare in some of the Swiss cantons that it is protected by law. The supposed difficulty of gathering it is the groundwork of various legends and poems; as the emblem of purity, it is given by the Tyrolean youth to his affianced bride. It is not difficult to cultivate and is found in American and European gardens, but is apt to lose its distinctive woolly character under cultivation.

**Edema**. See ŒDEMA.

**Eden, Emily**, English novelist and traveler: b. Old Palace Yard, Westminster, 3 March 1797; d. Richmond, England, 5 Aug. 1869. Among her works are: 'Portraits of the People and Princes of India' (1844); 'The Semi-detached House' (1859); 'The Semi-attached Couple' (1860).

**Eden, Sir Robert**, last proprietary governor of Maryland: b. Winderstone Hall, Durham, England; d. Annapolis, Md., 2 Sept. 1784. As captain in the Coldstream Guards he served in the Seven Years' war. He was appointed governor of Maryland in 1768, where he remained until 1776, when that State committed itself to the principles of the Revolution, and virtually declared the proprietary governorship at an end. He left in an English warship, but returned a few months before his death. See Steiner, 'Life and Administration of Sir Robert Eden.'

**Eden, William**. See AUCKLAND, WILLIAM EDEN, LORD.

**Eden**, the garden of paradise. It would be difficult in the whole history of opinion, to find any subject which has so invited and at the same time so completely baffled conjecture, as the Garden of Eden. The three continents of the Old World have been subjected to the

most rigorous search; but no locality which in the slightest degree corresponded to the description of the first abode of the human race has been left unexamined. Philo Judeus (flourished about 20) first broached the allegorical theory of interpretation, teaching that paradise shadowed forth the governing faculty of the soul, and that the tree of life represented religion, the true means of immortality. Origen, adopting a somewhat similar view, regarded Eden as heaven, the trees as angels, and the rivers as wisdom; and Ambrosius considered the terrestrial paradise and the third heaven, mentioned by St. Paul (2 Cor. xii. 2-4), as identical. Luther taught that Eden was guarded by angels from discovery and consequent profanation until the Deluge, when all traces were destroyed. Swedenborg, who regarded the first 11 chapters of Genesis as constituting a divine allegory, taught that Eden represented the state of innocence in which man was originally created and from which he degenerated in consequence of the Fall. The account given in Genesis of the situation of Eden is not such as to enable us to identify it with any existing locality. It is said to have had a garden in the eastern part of it, and we are told that a river went out of Eden to water this garden, and from thence it was parted into four heads, which were called respectively Pison, Gihon, Hiddekel, and Euphrates (Phrat). The Pison is said to compass the whole land of Havilah; the Gihon that of Ethiopia (Cush); and the Hiddekel to go toward the east of Assyria. Of the rivers mentioned the Phrat of the original seems to have been correctly identified with the Euphrates, and the name Hiddekel appears elsewhere in Scripture (Dan. x. 4) to be applied to the Tigris; but it is impossible to say what rivers or places were meant by the names Pison, Gihon, Havilah, and Cush. See ADAM.

**Eden**, a river in England, rising in a hill in Westmoreland, near the northwest boundary of Yorkshire; flows northwest, passing Appleby and Carlisle, and empties into the Solway Firth. Total course, about 50 miles.

**Eden of America**, a name bestowed on the island of Aquidneck, off the coast of Rhode Island, on account of its great fertility.

**Edenhall**, the ancient seat of the Musgraves in Cumberland, four miles northeast of Penrith, England. Here is still preserved the famous "Luck of Edenhall," an old painted glass goblet, said to have been snatched from the fairies, on the safety of which the welfare of the house depends. It is supposed to have been a chalice, and its leathern case bears a sacred monogram. Uhland's well-known ballad, 'The Luck of Edenhall,' has carried its fame beyond the British islands.

**Edentata**, ê-dên-tâ'ta, one of the smaller orders of mammals, most of which are found in South America. It includes the South American sloths, ant-eaters, and armadillos, and two Old World groups, all of which are characterized by an absence of front teeth, and in a few instances, of completely toothless jaws, whence the generic name. Where teeth are present they are without enamel, and lack distinct roots, are all alike, and generally are not preceded by a set of milk teeth. These animals are ranked comparatively low in the scale of

mammals, not only on account of their deficiency in teeth, but also because their brains are relatively small, and lack the convolutions characteristic of the more highly developed orders. With two exceptions, the armadillos and pangolins, the Edentata are clothed with coarse hair. The armadillos are peculiar among mammals, in that their bodies are covered with an armor of bony plate; and in the pangolins the entire body is protected by a coat of overlapping, horny scales. The typical edentates are the sloths (*Tardigrada*), the ant-eaters (*Vermilinguia*), and the armadillos (*Loricata*), all of which are American; the two groups in the order, native to Africa and Asia, are the pangolins (*Squimala*), and the aard-varks (*Podientia*), although Lydekker questions the correctness of placing the last two among the edentates, preferring to consider the present and extinct forms as an entirely American order. The sloths live on vegetable food exclusively, the other group chiefly on insects or animal matter softened by decay.

**Fossil Edentates.**—Of the large and numerous edentate fauna which lived in South America during the Tertiary and Quaternary periods, some (*Myiodon*, *Megalonix*, *Glyptodon*) spread to North America during the Pliocene and Pleistocene epochs; the armadillo is still found as far north as the Mexican border of the United States. Their earliest ancestors were, perhaps, North American, but their development was exclusively in the southern continent during most of the Tertiary Period. The earlier stages in their evolution were of small or moderate size; later on they became of huge size and very highly specialized. The most remarkable among them were the *Megatheriida* of the *Bruta* order, ground-sloths, distantly related to the modern true sloths, but terrestrial animals, very heavily proportioned, with massive hind quarters and tail, and immense digging claws; and the *Glyptodonts*, related to armadillos but much longer, with massive unjointed carapace like that of a tortoise, and with hoofs instead of claws. Besides these were numerous true armadillos, both large and small, some ancestral to the modern species, others of extinct races. No fossil ant-eaters have yet been discovered, and fossil tree-sloths are almost equally unknown; but the fossil beds of South America have been so imperfectly explored that this fact is not surprising.

**Edenton, N. C.**, town, county-seat of Chowan County; on the Albemarle Sound, near the mouth of the Chowan River; on two branches of the Norfolk, Va., B. & S. R.R.; about 90 miles north of Beaufort and 115 miles northeast of Raleigh. Four steamship lines enter Edenton, thus making it a good shipping point for the trade of the northeast part of the State. The shallow waters of the Albemarle Sound are a hindrance to more extensive shipping. The name given to the town when founded in 1712 was Queen Anne's Creek, but this was changed to Edenton in honor of a governor of the colony, Charles Eden. In less than one year after the "Boston Tea Party" a number of the housewives of Edenton resolved not to assist in supporting England by paying a tax on tea; and they formed themselves into an organization, none of whose members should drink tea. In addition to being first among

those who held Revolutionary tea parties, they seem to have been pioneers in America in the formation of organizations for women. The chief industries are lumbering and fishing. Pop. 3,210.

**Eder, a'dér, Joseph Maria**, Austrian chemist: b. Krems on the Danube 16 March 1855. He taught photo-chemistry at the Technical School, Vienna, and 1882 was made professor of chemistry at the Industrial School in that city. He has made great contributions to the development of the art of photography, particularly with reference to the use of chloride or bromide of silver. He also invented a photometre for measuring the invisible ultra violet rays by the oxalate of mercury. Among his works are: 'Photographie aux sels de chrome'; 'Etudes sur l'action de la lumière colorée' (1879); 'Manuel de photographie' (1882).

**Edes, Robert Thaxter**, American physician: b. Eastport, Maine, 23 Sept. 1838. He was graduated at Harvard 1858, and at the Harvard Medical School 1861; served as surgeon in the United States navy 1861-5; was professor of materia medica 1870-84; and professor of clinical medicine 1884-6 at the Harvard Medical School. He was physician at the Boston City Hospital 1872-86, and at the Garfield Memorial Hospital, Washington, 1889-91, and resident physician at the Adams Asylum 1891-7. Among his works are: 'Nature and Time in the Cure of Diseases' (1868); 'Physiology and Pathology of the Sympathetic or Ganglionic Nervous System' (1869); 'Therapeutic Handbook of the United States Pharmacopœia' (1883); 'Therapeutics and Materia Medica' (1887); and many contributions to medical journals at home and abroad.

**Edes'sa**, the name of two ancient cities. (1) The ancient capital of Macedonia, and the burial place of its kings, now Vodhena. It is probably the same with the still more ancient Ægæ. (2) An important city in the north of Mesopotamia, which, subsequent to the establishment of Christianity, became celebrated for its theological schools. During the centuries which were affected by the Christianizing of Rome, Edessa became the centre of learning of Syria. (See SYRIA; SYRUS.) The modern city of Urfah or Orfa stands on the site once occupied by Edessa. (See URFAH.) In 1089, in the first crusade, Edessa came into the hands of Baldwin, but ultimately became part of the Turkish empire. It was one of the greatest four cities of Syria, the other three being Antioch, Damascus, and Nisibis.

**Edfu, ɛd'foo**, town of Upper Egypt; situated on the Nile, 54 miles southeast of Thebes. It contains the remains of two temples, the larger of which is the best preserved monument of its kind in Egypt. It was founded by Ptolemy III. Philopator more than two centuries before Christ, and added to by his successors down to Ptolemy XIII. Dionysus, a period of 170 years. The general plan of the temple resembles that of Dendera. Its length is 451 feet, the breadth of its façade is 250 feet. Its entrance is by a gateway 50 feet high, between two immense truncated pylons, 37 feet wide at the base, and 115 feet high, the whole surface covered with sculptures and inscriptions



in low relief. This splendid façade is visible from a great distance, and is one of the most commanding sights in the Nile valley. Passing through this entrance, a court is reached 161 feet long, and 140 feet wide, enclosed by a splendid colonnade of 32 columns of every variety of capital, and surrounded by walls between which and the pillars there is a stone roof, forming a covered portico. From this court opens a hypostyle hall of 18 columns, joined by an intercolumnial screen, through which access is obtained to an inner hall of 12 columns, leading to the sanctuary, where a great monolith of gray granite was evidently intended to encage the hawk, the sacred emblem of Hor-Hud, the local Horus, to whom the temple was dedicated.

The sanctuary and surrounding chambers, together with the outer and inner halls, are separated by an open corridor from the outer wall of the temple, and both sides of this passage are covered with elaborate reliefs and numerous inscriptions, which present a sort of encyclopædia of ancient Egyptian geography, ritual, and ecclesiastical topography, with calendars of feasts, lists of divinities in the various names and cities, and even a species of church directory, including the names of singers and other temple officials. The smaller temple, erected by Ptolemy Physcon and Lathyrus, consists of only two chambers. The manufactures of Edfu at present are blue cotton cloths, and earthen-ware similar to the ancient Egyptian pottery. Pop. 2,500.

Consult: Wiedemann, 'Religion of the Ancient Egyptians'; Mariette, 'Monuments of Upper Egypt.'

**Edgar** ("THE PEACEABLE"), one of the most distinguished of the Saxon kings of England, was the son of King Edmund. He succeeded to the throne in 958, and managed the civil and military affairs of his kingdom with great vigor and success. He maintained a body of troops to control the mutinous Northumbrians, and repel the incursions of the Scots, and fitted out a powerful navy to protect his subjects from the Danes. During the reign of Edgar wolves were nearly extirpated from the southern parts of the island, by exchanging a tribute from Wales for payment in the heads of these animals. He married Elfri, daughter of the Earl of Devonshire, in 965. It was during his reign that Dunstan was primate of England. (See DUNSTAN, SAINT.) He died in 975, and was succeeded by his son, Edward the Martyr.

**Edgar Atheling**, Anglo-Saxon prince: b. Hungary about 1057; d. toward the end of the 11th century. He was a grandson of Edmund Ironside, and his life may be epitomized as a series of abortive attempts. Selected by Edward the Confessor as his prospective heir, he was kept out of the throne by William the Conqueror (1066); having twice engaged in the northern revolts against the Normans, he was twice compelled to take refuge in Scotland, with Malcolm Canmore, who married Edgar's sister, Margaret; then, embracing the cause of Robert, Duke of Normandy, against William Rufus, he was driven away (1091) from the duchy to Scotland; then he embarked (1099) in a bootless crusading expedition to the East; and finally was taken prisoner at Tenchebrai (1106) fighting for Duke Robert against his brother Henry I. Almost the only successful achievement of his life

seems to have been that of reseating his nephew Edgar on the throne of Scotland (1097), which had been usurped by Donald Bane. His last days were spent in obscurity; the date of his death is not precisely known.

**Edgar, James David**, Canadian statesman: b. Hatley, P. Q., 10 Aug. 1841. He was admitted to the bar 1864, first practising in Toronto; was made a Q.C. by the Ontario government in 1890. In 1872 he was elected to Parliament for Monck, being chief Liberal "Whip"; served on a political mission to British Columbia, and was re-elected from West Ontario 1884. He was elected speaker of the commons in the new parliament 1896, and was instrumental in passing the Canadian Copyright Act 1889. Later he devoted much attention to the question of international arbitration. He was elected a Fellow of the Royal Society of Canada 1897. He has published: 'The White Stone Canoe' (1887); 'This Canada of Ours and Other Poems' (1893); an 'Annotated Edition of the Insolvent Law' (1864); and several other law books.

**Edgar, John George**, English biographer and historian: b. 1834; d. 1864. In business at Liverpool, he left it for literature: edited 'Every Boy's Magazine,' contributed to the London press, and wrote biographies and histories, mainly for the young; among them: 'The Boyhood of Great Men' (1853); 'Footprints of Famous Men' (1853); 'Crusades and Crusaders' (1859); 'Sea Kings and Naval Heroes' (1860); 'Cavaliers and Roundheads' (1861).

**Edgartown**, Mass., town, county-seat of Duke's County; situated on the eastern shore of the island of Martha's Vineyard. At present it is a summer resort, but it was once a whaling station of importance. The town was settled in 1642. Pop. (1900) 1,209.

**Edgcumbe**, ěj'cũm, **SIR EDWARD ROBERT PEARCE**, English traveler: b. 13 March 1851. He was educated at Cambridge, was mayor of Dorchester 1891, and sheriff of Cornwall 1896. He has published: 'Zephyrus, or Travels in Brazil and on the River Plata' (1887); 'Bastiat's Popular Fallacies' (4th ed. 1893); 'Popular Fallacies Regarding Bimetallism' (1896); 'The Parentage and Kinsfolk of Sir Joshua Reynolds' (1901).

**Edgehill**, ěj'hil, England, an eminence in Warwickshire, 12 miles south of Warwick. Here was fought the first battle of the civil war, Sunday, 23 Oct. 1624, between the Royalists under Charles I. and the forces of the Parliament under the Earl of Essex. It was an indecisive engagement.

**Edgeworth**, ěj'wẽrth, **MARIA**, English novelist: b. Hare Hatch, near Reading, Berkshire, 1 Jan. 1767; d. Edgeworthstown, Ireland, 21 May 1849. In 1782 her father, Richard Lovell Edgeworth, succeeded to the family estate of Edgeworthstown, in the county of Longford, Ireland, and thither he proceeded and took up his abode. In 1802 she established her position as an author by her 'Castle Rackrent,' a novel of Irish life, in which the manners and customs of a by-gone generation are most graphically and humorously described. A 'Treatise on Irish Bulls' appeared in 1803, and about the same time she began the series of tales on which her fame will rest. These comprise: 'Moral Tales';



'Popular Tales'; and 'Tales of Fashionable Life', all written in the clearest and most vigorous style, without the least affectation of sentiment or fine writing. She also wrote: 'The Parents' Assistant,' a collection of tales for children, and the well-known series of 'Early Lessons'; 'Harry and Lucy'; 'Frank'; and 'Rosamond.' Belonging to the class of regular novels are 'Belinda'; 'Leonora'; 'Patronage'; 'Harrington'; and 'Ormond.' In estimating Miss Edgeworth's literary merits too much praise cannot be given to her terse and nervous style, alike simple and elegant, or to the lucidity and consecutiveness which characterize all her compositions. Her skill in plot is considerable, and the interest excited in the characters and issue of the story is never allowed to flag. See Thackeray Ritchie, 'Book of Sibyls' (1883); Zimmern, 'Life of Maria Edgeworth' (1883).

Edgren, Anne Charlotte Leffler, än shär-löt'tē lēf-lēr ēd'grēn, Swedish novelist and dramatist: b. Stockholm 1 Oct. 1849; d. Naples 24 Oct. 1892. A volume of short tales, 'By Chance,' and the dramas, 'The Actress'; 'The Curate'; etc., were a great success anonymously; and she then put her own name to three successive volumes of short stories called 'From Life,' followed by 'A Summer Story'; 'Woman and Erotism'; and many others. 'Ideal Women'; 'The Struggle for Happiness'; and 'A Rescuing Angel' (the most successful of her plays), are notable among her later dramas.

Edgren, August Hjalmar, Swedish-American educator: b. Wermland, Sweden, 18 Oct. 1840. He came to the United States in 1860, joined the 99th New York Regiment as second lieutenant January 1862; and in August 1863 entered the engineer corps. He was connected with Yale University 1874-80, and since 1893 has been professor of Sanskrit and linguistic science at the University of Nebraska. His numerous publications include a Swedish work on the 'Literature of America' (1878); 'Swedish Literature in America' (1883); and 'American Antiquities' (1885); besides many valuable papers for students, pertaining to Sanskrit, romance, and Germanic philology.

Edhem Pasha, pash-ā' or pāsh'a, Turkish soldier and statesman: b. Scio of Greek parentage 1813. He studied in Paris, and on returning to Turkey was attached to the staff of the army with the rank of captain, rapidly attained that of colonel, and was appointed a member of the Council of Mines at the time of its formation. Having been appointed aide-de-camp to the Sultan in 1849, he soon was placed at the head of His Majesty's household troops. In 1856 he resigned the functions which he had fulfilled at the palace, and was appointed a member of the council of the Tanzimat, and afterward minister of foreign affairs, with the rank of *muchir*. Subsequently he played an important part in the affairs of his country, where he was nominated president of the Council of State. He was also for some time ambassador at Berlin. At the Conference of Constantinople (1876-7) he acted as the second Turkish plenipotentiary, and was appointed to succeed Midhat Pasha as grand vizier, 5 Feb. 1877.

Edhem Pasha, Turkish soldier: b. 1851. In 1877 he held the rank of colonel in the Turkish army and rose rapidly during the war with Russia. He was appointed governor-general of the Vilayet of Kossowo, and was later made adjutant-general and field marshal. In the war with Greece (1896-7) he had the chief command of the Turkish army.

Edible Birds' Nests. See BIRDS' NESTS, EDIBLE.

Edict, a public proclamation. In ancient Rome, the higher officers of state, who were elected annually, publicly declared, at their entrance upon office, the principles by which they should conduct their administration. This was done particularly by the *ediles*, who superintended buildings and markets, and by the *prætors*, as supreme judges. These annual proclamations, by which the deficiencies of the general statutes were supplied, and the laws were adapted to the peculiar wants of the period, gradually acquired a certain permanency, as each officer retained, unaltered, most of the regulations of his predecessor (*edictum tralatitium*); and they became, in fact, the source of that branch of Roman law which, being founded on the official authority of the authors, was called *jus honorarium*, and was opposed to the strictly formal law, *jus civile*. Though according to Roman jurists these usually indirect forms of legislation had their object in rendering the civil law more expedient to the public welfare, and always received the seal of the people's approval. Edicts were sometimes made for some special occasion, in which case they were called *edicta repetina*. It was against the abuse of this kind of edicts that the Lex Cornelia in 67 B.C. was directed. Those which were applicable in all cases during the tenure of office of the magistrate who issued them were called *edicta perpetua*. The name of *edictum perpetuum* was also given to a collection and arrangement of the clauses which the *prætors* were accustomed to put into their annual edicts, made under the Emperor Hadrian by Salvius Julianus about 131 A.D. What the exact nature of the work thus done by Julianus was is not known, but the edict prepared by him, and sanctioned by imperial authority, had unquestionably a special force, and it is likely that it restricted in future the right enjoyed by magistrates of issuing edicts, to such cases as were not provided for in the edict of Julianus. Only a few fragments of the ancient Roman edicts have been preserved. See CIVIL LAW.

Edict of Nantes, a decree of Henry IV. king of France, published 13 April 1598, by which he conceded to the Huguenots, or Protestants of that kingdom, toleration for their religious beliefs, teachings, and practises; freedom of public worship and liberty to erect churches, except at Paris and the royal residences, and to maintain the four Protestant universities of Saumur, Montauban, Montpellier, and Sedan; admission as members to the parliament of Paris and the right to special chambers in the parliaments of Grenoble and Bordeaux; further, the right to hold provincial and national synods. In 1620 the Huguenots in their political congress at La Rochelle confiscated all the property of the Roman Catholic churches and constituted throughout France a military and civil organization for Huguenot ends.

## EDINA — EDINBURGH

Before the formal revocation of the Edict of Nantes the liberties of the Protestants were largely restricted by partial acts of revocation, which precluded them from office in the government, from membership in trade corporations, etc., and from marriage with Roman Catholics. The edict was formally revoked by a decree of Louis XIV. 18 Oct. 1685. It ordered the churches of the Huguenots to be destroyed, forbade the holding of religious meetings and of synods by Protestants on penalty of confiscation of goods; banished all Protestant ministers; ordered the children of Protestants to be baptized and brought up as Roman Catholics. The Huguenots to the number of some 500,000 made for the frontiers or the coast and sought an asylum in Great Britain, Holland, Switzerland, Prussia, and the American colonies of England. In all those countries they proved themselves as artisans and artificers, a valuable accession to the nations that received them, and added materially to the strength of the enemies and the rivals of France, both in peace and in war.

**Edi'na**, Mo., city, county-seat of Knox County; on the Omaha, K. C. & E. R.R., about 110 miles north of Jefferson City. Its manufactures are principally lumber, flour, butter, wagons, and carriages; and the trade is chiefly in agricultural products, stock, and the imports needed for local consumption. Pop. 1,700.

**Edina**, or **Edin**, a synonym for Edinburgh, introduced by George Buchanan, and frequently met in Scottish poetry. See **DUNE EDIN**.

**Edinburgh**, *ēd-in-būr'ō*, **Duke of** (**PRINCE ALFRED ERNEST ALBERT**), Duke and sovereign of Saxe-Coburg-Gotha, English prince: b. Windsor Castle 6 Aug. 1844; d. Coburg, Germany, 30 July 1900. He was the second son of Queen Victoria and at the age of 14 joined the navy as naval cadet, and served on various foreign stations. In 1862 he declined the offer of the throne of Greece. On his majority he was awarded an annuity of £15,000 by Parliament, and was created Duke of Edinburgh, Earl of Kent, and Earl of Ulster. In 1873 he received an additional annuity of £10,000, and next year married the Grand-duchess Marie, only daughter of the emperor of Russia. In 1882 he was made a vice-admiral, and subsequently held important commands, being also created admiral of the fleet. In 1893 he succeeded his uncle as ruler of Saxe-Coburg-Gotha, and resigned his annuity of £15,000. He was succeeded by his nephew, the Duke of Albany.

**Edinburgh**, **Edinburghshire**, or **Midlothian**, a maritime county of Scotland; area, 231,724 acres. The surface is hilly and the productions are about as in Scotland generally. The chief town is Edinburgh. (See **EDINBURGH**.) Pop. (1900) 488,647.

**Edinburgh**, Scotland, the chief city of Scotland, and one of the finest as well as most ancient cities in the British empire; lies within two miles of the south shore of the Firth of Forth. It is picturesquely situated, being built on three eminences and surrounded on all sides by lofty hills except on the north, where the ground slopes gently toward the Firth of Forth. The central ridge, which constituted the site of the ancient city, is terminated by the castle on the west, situated on a high rock, and by Holy-

rood House on the east, nor far from which rise the lofty elevations of Salisbury Crags, Arthur's Seat (822 feet high), and the Calton Hill overlooking the city. The valley to the north, once the North Loch, but now drained and traversed by the North British Railway, leads to the New Town on the rising ground beyond, a splendid assemblage of streets, squares, and gardens. The houses here, all built of a beautiful white freestone found in the neighborhood, are comparatively modern and remarkably handsome.

The principal streets of the New Town are Prince's Street, George Street, and Queen Street. Prince's Street is adorned with Sir Walter Scott's monument and other notable buildings. The principal street of the Old Town is that which occupies the crest of the ridge on which the latter is built, and which bears at different points the names of Canongate, High Street, Lawnmarket, and Castle Hill. This ancient and very remarkable street is upward of a mile in length, rising gradually with a regular incline from a small plain at the eastern end of the town, on which stands the palace of Holyrood, and terminating in the huge rock on which the castle is built, 383 feet above sea-level. The houses are lofty and of antique appearance. Among the notable buildings are the ancient Parliament House, now the seat of the supreme courts of Scotland; St. Giles' Church or cathedral, an imposing edifice in the later Gothic style, recently carefully restored; the Tron Church; Victoria Hall (where the General Assembly of the Established Church meets); the Bank of Scotland; besides some of the old family houses of the Scottish nobility and other buildings of antiquarian interest. At right angles to this main street and in regular rows are numerous narrow lanes called closes, many of them extremely steep, and very few at their entrances more than six feet wide; those which are broader, and admit of the passage of carriages, are called wynds. In these and the adjacent streets the houses are frequently more than 120 feet high, and divided into from 6 to 10 stories, or flats, the communication between which is maintained by broad stone stairs, winding from the lowest part of the building to the top. In the Old Town the most remarkable public building is the castle. This fortress contains accommodations for 2,000 soldiers, and the armory space for 30,000 stand of arms. In an apartment here is kept the ancient regalia of Scotland.

The palace of Holyrood, or Holyrood House, as it is more generally called, stands, as already mentioned, at the lower or eastern extremity of the street leading to the castle. No part of the present palace is older than the time of James V. (1528), while the greater portion of it dates only from the time of Charles II. In the north-western angle of the building are the apartments which were occupied by Queen Mary, nearly in the same state in which they were left by that unfortunate princess. Adjoining the palace are the ruins of the chapel belonging to the Abbey of Holyrood, founded in 1128 by David I. The Advocates' Library, the largest library in Scotland, contains upward of 250,000 printed volumes and 2,000 MSS.

On the southern side of the Old Town, and separated from it also by a hollow crossed by two bridges (the South Bridge and George IV.

Bridge), stands the remaining portion of the city, which, with the exception of a few unimportant streets, is mostly modern. Besides the buildings already noticed Edinburgh possesses a large number of important edifices and institutions, chief among which are the Royal Institution (containing accommodation for various bodies), the National Gallery of Scotland, the Museum of Science and Art, the new Episcopal Cathedral of St. Mary's, etc. Among the more prominent educational institutions are the university, the high school, the academy, the New or Free Church Theological College, the United Presbyterian Theological Hall, the Edinburgh School of Medicine, the Veterinary College, the Fettes College, the Heriot-Watt College of Science and Literature. The manufactures of Edinburgh are neither extensive nor important. Printing, book-binding, coach-building, type-founding, machine-making, furniture-making, ale-brewing, and distilling are the principal industries. Edinburgh is the headquarters of the book trade in Scotland, and the seat of the chief government departments.

The origin of Edinburgh is uncertain. Its name is thought to be derived from Eadwinsburgh, the Burgh of Edwin, a powerful Northumbrian king who absorbed the Lothians in his rule. The town was made a royal burgh in the time of David I.; but it was not till the 15th century that it became the recognized capital of Scotland. Pop. (1901) 316,479.

**Edinburgh Review, The**, one of the most celebrated of English quarterlies. It was established in October 1802, at a time when the periodical literature of Great Britain consisted of works conducted with inferior talent and occupying narrow grounds. Its success was immediate. All the great subjects of literature, science, philosophy, and politics were discussed in it with boldness, spirit, varied learning, acute reasoning, elegant criticism, a piquant satire, and original views. It was started by a number of young men in Edinburgh who were accustomed to meet occasionally to discuss questions connected with literature, politics, philosophy, and poetry. The principal of these were Henry Brougham (q.v.), Francis Jeffrey (q.v.), Sydney Smith (q.v.), and Francis Horner. It was edited for a few numbers by Sydney Smith; afterward Jeffrey was the editor from 1803 to 1829, and was one of the most fruitful contributors throughout the long time during which he conducted it. Under his editorship the periodical reached the highest summit of its prosperity, when it had from 12,000 to 13,000 subscribers. Jeffrey was succeeded by Macvey Napier. Among the principal writers (besides those above mentioned) are to be found the names of Playfair, Leslie, Sir Walter Scott, Sir W. Hamilton, Mackintosh, Dugald Stewart, Dr. Thomas Brown, Carlyle, Macaulay, James Mill, Hallam, etc. At present the quarterly is published in London, and upon its centenary (1902) issued a commemorative number.

**Edinburgh, Treaty of**, an engagement negotiated 6 July 1560, between Queen Elizabeth and the Scots for the evacuation of Scotland by the French. By this treaty Francis II. and Mary fully recognized the right of Elizabeth to the English crown, and agreed that Mary, in time to come, should neither assume the title nor bear the arms of England.

**Edinburgh University**, the latest of the Scottish universities, was founded in 1582 by a charter granted by James VI. The government, as in the other Scottish universities, is vested in the Senatus Academicus, the university court, and the general council. The chancellor of the university is elected for life by the general council. He is the head of the university and the president of the general council. The rector is elected for a term of three years by the matriculated students. He presides over the university court. The principal is the resident head of the college and president of the Senatus Academicus. The university court consists of the rector, principal, the lord-provost of Edinburgh, and assessors appointed by the chancellor, town council of Edinburgh, the rector, the general council, and the senatus respectively. The general council consists of the chancellor, the members of the university court, the professors, and all graduates of the university. There are four faculties, namely, arts, divinity, law, and medicine. Women may now graduate in arts, science, and medicine. The medical department has an international reputation and attracts students from all parts of the world. Some of the professors are appointed by the crown, others are elected by the university court and by special electors, and a considerable number by the curators, who also elect the principal.

In 1902 the teaching staff numbered 105, and the students about 3,000. The degree of M.A. is conferred on all who have completed their course and passed the ordinary examinations in the classical department (Latin and Greek), the department of mathematics and natural philosophy, and that of logic and metaphysics, moral philosophy, and rhetoric and English literature. Three medical degrees are conferred: Bachelor of Medicine (M.B.), Master in Surgery (C.M.), and Doctor of Medicine (M.D.). The degrees in law are Bachelor of Laws (LL.B.), Bachelor of the Law (B.L.), and Doctor of Laws (LL.D.). The last is purely honorary. The degrees of Bachelor of Divinity (B.D.), and Doctor of Divinity (D.D.), the latter honorary, are bestowed in the faculty of divinity. Degrees in science are also conferred. The degree of D.Sc. is conferred in the physical, in the natural, and in the mathematical sciences, in engineering, in public health or sanitary science, in mental science, and in philology. That of B.Sc. is conferred only in mathematical, physical, and natural science, in engineering, and in public health. The present university buildings were begun in 1789. The library of the university contains about 170,000 printed volumes, besides 2,000 manuscripts. There is also a separate theological library containing about 10,000 volumes. There are various bursaries, scholarships, and fellowships, amounting annually to about \$50,000.

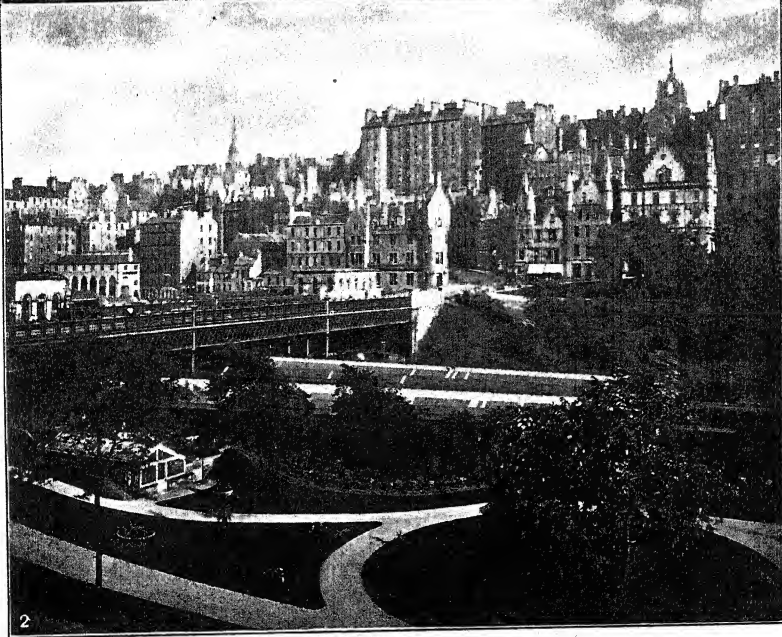
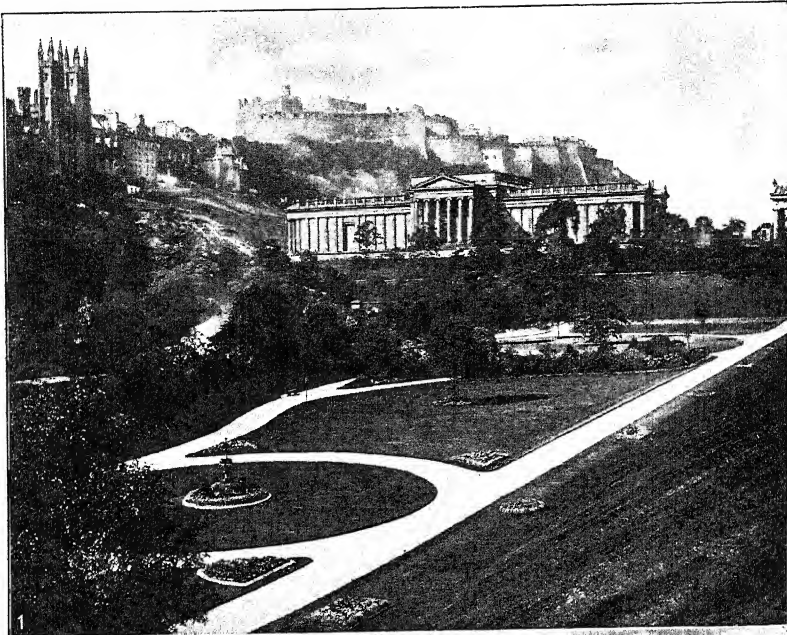
**Edis, Robert William**, English architect: b. Huntingdon, England, 13 June 1839. He was president of the Architectural Association for two years, and among his constructions may be mentioned the club houses of the Constitutional, Junior Constitutional, and Badminton clubs, London; and the Conservative Club, Glasgow; The Great Central Hotel, London, and the Inner Temple Library. He has written and lectured much upon domestic art and house sanitation, and is a strong advocate of the extended use of



THOMAS ALVA EDISON,  
AMERICAN ELECTRICIAN AND INVENTOR.



EDINBURGH.



1. The Castle and Museum.
2. The Old Town, from Princess Street.





## EDISON — EDISON PORTLAND CEMENT WORKS

terra-cotta in building. He has published: 'Decoration and Furniture of London Houses'; 'Hand-book on Healthy Furniture'; etc.

**Edison, Thomas Alva**, American electrician and inventor: b. Milan, Ohio, 11 Feb. 1847. When he was seven years of age his family moved to Port Huron, Mich. Being denied ordinary school privilege, young Edison sought to earn his livelihood, and at the age of 12 became a newsboy on the Detroit and Port Huron branch of the Grand Trunk Railway. His leisure hours were spent in reading and boyish experiment with printing presses and telegraph instruments. He bought a small hand press, and in 1862 published a small weekly newspaper known as the 'Grand Trunk Herald.' His office was in an abandoned freight car where he continued his mechanical experiments. Later he learned to become a telegraph operator at Mount Clemens. Although a brilliant and rapid operator his erratic conduct, being given to pranks and fun-making, lost him several situations. While in Indianapolis in 1864, he invented an automatic telegraph repeater, the first of a long series of improvements and inventions. He soon after went to Boston, where he invented a commercial stock indicator, which he sold to New York capitalists for \$40,000. This gave him the long-cherished opportunity of establishing an extensive laboratory, which he did at Newark, N. J., for the special manufacture of electrical, printing, automatic and other apparatus. In 1876 his health failed and he gave up manufacturing, confining his labor to investigation and invention. He established his laboratory at Menlo Park, N. J., and later at West Orange, N. J., gave employment to hundreds of workmen and became known as one of the greatest inventors of the 19th century. More than 300 patents have been issued on his inventions, and he has besides produced hundreds of minor contrivances and improvements not covered by patents. Among his more important inventions may be named the phonograph, a telephone for long distance transmission, a system of duplex telegraphy (which he subsequently developed into quadruplex and sextuplex transmission), the carbon telephone transmitter, the microtasmeter, the ærophone, megaphone, the incandescent electric lamp, the kinetoscope, and a storage battery for street railway cars and automobiles. There is not an electrical instrument, or an electrical process now in use, but bears the mark of some great change wrought by the most ingenious of Americans. In 1878 he was made chevalier of the Legion of Honor by the French government, a commander of the Legion in 1889, and was the recipient of the insignia of a grand officer of the Crown of Italy bestowed the same year by King Humbert. In 1892 he received the Albert medal of the Society of Arts of Great Britain.

Edison is a man of remarkable personality. To those who believe his work is the product of an inspiration given by nature to but few, the story of the manner in which he achieves success will seem shockingly unromantic. In the genius who works by inspiration Edison has no great faith. "Genius is 2 per cent inspiration and 98 per cent perspiration," is the incisive, epigrammatic answer he once gave to a man who thought that a genius worked only when the spirit moved him. Not being given to scientific

rhapsodies, Edison does not concern himself with what may be of service a century hence; he confines himself rigorously to the needs of the present. Knowing full well that he is probably not the first who has set for himself the task in the performance of which he is engaged, he reads all that is pertinent to his subject in the vast library which forms an important adjunct of his laboratory. Not content with the information gathered from his own shelves his literary agent is ordered to send him more. After a thorough review of his subject, Edison begins laboratory work—an expert keenly alive to the failures of his predecessors, careful to avoid useless repetitions of old experiments. It is now that the 2 per cent inspiration gained by exhaustive reading, and the 98 per cent perspiration which he is ready to expend, are applied. Experiments are made; not a few, but hundreds and even thousands. Model after model is built. Failure upon failure is met with, until further efforts seem hopeless. Undismayed, Edison performs more experiments, builds more models. Failure spurs him on. At last an experiment is performed or a model made which gives faint encouragement. So far from being elated, he regards the promising result with great suspicion. The failures have been too many; the apparent success after all may be due to an accidental combination of circumstances that may never occur again. Only after the partial triumph has been confirmed by many trials does complete assurance come. Edison knows exactly what he wishes to accomplish, and how his end is to be attained. Absolute certainty of purpose and of method saves him from frittering away his time in useless experimentation. Chance has given perhaps an occasional idea, but it has not lightened his work. Tireless perseverance and long hours of work are the secrets of Edison's success. In 1897 Edison devoted his exclusive attention to the invention of a new storage battery, on which problem he had been engaged for some five years. For over a year he worked harder than a day laborer. He was at his laboratory at 7.30 in the morning. His luncheon was sent to him. In the evening he left for dinner, but returned at 8. At 11.30 at night his carriage called for him; but often the coachman had to wait for three or four hours until the inventor came out of his laboratory. Yet when vacation time comes, and with it a chance to leave his laboratory, Edison plays just as he works, with his whole heart and soul. He will hear nothing of business. Science is thrown to the winds.

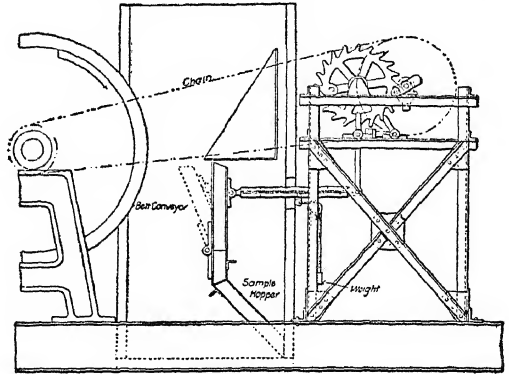
**Edison Portland Cement Works**, a manufacturing establishment located at Stewartsville, N. J., and interesting for its employment of new methods, devised by the well-known inventor, T. A. Edison (q.v.), in the making of Portland cement. The rock, having been drawn on flatcars to the crusher-house, is raised by electric hoists and dumped into the crushing-rolls. These rolls are arranged in four sets, one above the other, the material passing downward by gravity. The first set of rolls is 5 feet in length and diameter, the moving portions weighing approximately 25 tons each. They can receive and crush rocks of 5-ton weight, and are driven at a speed of 200 revolutions per minute. Beneath these rolls is a 10-ton hopper, from which the material is fed to three sets of

## EDISON PORTLAND CEMENT WORKS

36-inch rolls. The rock in passing through the four sets is reduced to one half inch in size. The crusher house has a capacity of 3,000 tons per day of 24 hours, allowing for 16 hours of actual running and a maximum of 4 hours for stoppages. From the lowest set of rolls the crushed rock drops through a chute to a 24-inch belt conveyer, which transfers it to the top of the drier-house. Having arrived at the top of the drier-house, the material falls by gravity over screens composed of one half inch mesh screened plates. The rejected spalls are re-crushed and returned to the drier-house. The re-crushed material falls to the drier. The drier consists of a cast-iron box, 40 feet high and 8x8, filled with baffle-plates. Like the crusher, it has a capacity of 3,000 tons daily. The fall of the rock from the last screen to the bottom of the drier requires 26 seconds; the moisture in the crushed rock is reduced from 3 to 4 per cent to within 1 per cent. From the bottom of the drier stock a 24-inch belt conveyer transfers the dried rock to a transfer-tower, where it is received by another 24-inch belt conveyer, which passes along the entire length of the stock-house cupola, and deposits the rock in any bin desired by a self-propelling tripper. There are three bins for cement rock, three for lime rock, and one for mixing purposes. At the transfer tower an automatic sampler is installed, and this withdraws samples of the material as it is dumped from one conveyer to the other. By analysis of the material removed by the sampler, the general constituents of the material in any given bin may be ascertained. Great precautions are taken to dry the material in stock-house, should it become wet after leaving the drier. A 15-foot fan, passing 60,000 cubic feet of air per minute, creates a suction of warm air through the building from the furnaces at the other end, and thus removes excess moisture in the stored stock.

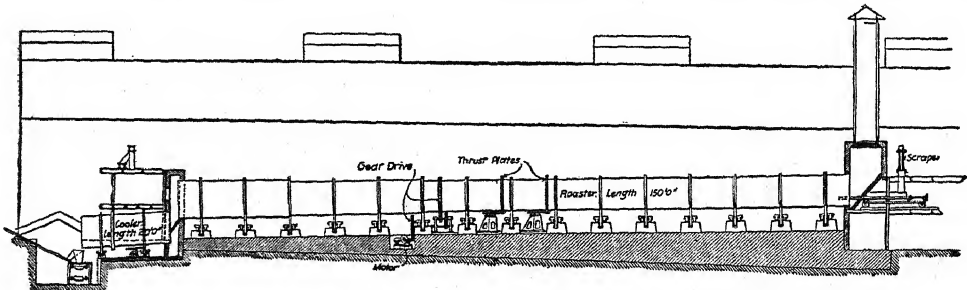
For the next step in the process of manufacture, the crushed rock emerges on a conveyer in a tunnel underneath the bins. By another conveyer it is raised to the first dump at the upper part of the weighing-house. Here are two bins, of 60 tons capacity each, one for the cement rock and one for the limestone. Beneath each of these bins is located a 10-ton weighing bin, the proper proportion of the raw

veyer which traverses the length of the building and passes two stationary trippers. Each tripper supplies 8 bins, whence the material is supplied to the discharge pipes of an equal number of fan-blowers. By a system of baffle-plates the material falls through the current of air maintained by the blower. The fine material is carried by the air-current to settling-chambers, whence it passes to bins. The coarse material is taken by conveyers to the chalk-grinding



The Automatic Sampler.

house for a further reduction. The set of fine grinding-rolls in the chalk-grinding house have a record of 280 barrels per hour. Of this ground material, 85 per cent passes through a sieve of 200 meshes per linear inch. From the stock-house, which has a capacity of 1,000 tons of chalk, the finely-ground material is conveyed to the burning plant. The kilns are of cast iron, 150 feet long and from 8 to 9 feet in exterior diameter. Each rotary kiln is supported on 30 wheels at 15 points of its length, and is moved at a speed varying from one revolution in 35 seconds to one in 40. The output of each kiln is about 750 barrels per day of 24 hours. The clinker formed by the vitrification of the chalk drops out at the lower end of the kiln into a revolving cylindrical cooler. Ordinarily the clinker from the cooler is spouted directly from the bucket conveyer. A second spout carries the clinker away to the bad clinker elevator. Thus defec-



A longitudinal section of one of the 150-foot kilns.

materials being secured in these latter bins. At the small rock stock-house begins a long tunnel, containing a 36-inch belt conveyer, which passes another raw-material or chalk-grinding house, where it receives the material furnished by the rolls, and whence it rises to the top of the blower-house. It is there received by a con-

veyer which traverses the length of the building and passes two stationary trippers. Each tripper supplies 8 bins, whence the material is supplied to the discharge pipes of an equal number of fan-blowers. By a system of baffle-plates the material falls through the current of air maintained by the blower. The fine material is carried by the air-current to settling-chambers, whence it passes to bins. The coarse material is taken by conveyers to the chalk-grinding

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## EDISTO — EDMUND

to the clinker grinders; then to a second blower-house, where fine and coarse are similarly separated, and thence to the cement stock-house. See CEMENT.

**Edisto**, *ēd'is-to*, a river in South Carolina, which has its rise in the southern part of the State, and which flows in a general direction southeast into the Atlantic Ocean. Its source is at the junction of two streams called North and South Forks of the Edisto River, and it flows into the ocean by two mouths, between which lies Edisto Island (q.v.). The river is 150 miles in length and navigable for 100 miles.

**Edisto Island**, an island on the coast of South Carolina, about 25 miles below Charleston, and is practically the delta of the Edisto River, which enters the sea by two arms. The soil is particularly adapted for the raising of cotton, the long-fibred product being known as Sea Island cotton. The vegetable industry on the island, raising and shipping vegetables to the Northern markets, has grown to large proportions. Pop. 482.

**Ed'monton**, Canada, town in the district of Alberta; on the north fork of the Saskatchewan River, and on a branch of the Canadian P. R.R., about 190 miles north of Calgary. Edmonton is the trading centre of an immense region which is rich agriculturally, and has valuable deposits of the precious metals, gold being found in places. The town was originally a settlement of the Hudson Bay Company, and one of the most important fur trading depots in the Northwest, and it has still considerable of this trade. Pop. (1901) 2,662.

**Edmonton**, England, town in the county of Middlesex, on the New River, eight miles north of London. An extensive trade in timber and other merchandise is carried on here by means of the Lea River navigation. The "Bell at Edmonton" has become famous by association with the adventures of John Gilpin. Charles Lamb died at Edmonton in 1834. Pop. (1901) 46,899.

**Ed'mund, Saint**, king of the East-Angles: b. Nuremberg 841; d. Oxon, now Hoxon, England, 20 Nov. 870. Edmund belonged, by blood, to the English-Saxon kings, but was not a direct heir to the throne. When Edmund was only in his 15th year, Offa, the king of the East-Angles, desiring to end his days in peace and penance, entreated him to accept the crown and become king. Accordingly he was crowned by Humbert, bishop of Elman, on Christmas Day 855, at Burum, a royal villa on the Stour, now called Bures. Although young in years, he was old in wisdom, and reigned with so much of justice and mercy that he was beloved by all his people. In the 15th year of his reign the land was attacked by the Danes, and they laid waste all the country through which they passed. The king tried to protect his people, but the Danes outnumbered them and spared none. Proposals insulting to religion were made to the king by the Danes, and the promise that his life would be spared if he complied; but the king repulsed their overtures because of the conditions. He was captured at Oxon and the terms, prejudicial to religion, were again offered and rejected. Hinguar, the Dane, exasperated at Edmund's refusal, ordered him to be beaten

with cudgels, and further most terrible tortures to be inflicted. Again he was offered terms of surrender, and again he refused. Hinguar at last ordered his head to be cut off. Saint Dunstan wrote an account of his death as witnessed by one who was armor-bearer of King Edmund. Some time after the body was removed from Oxon to Bedricsworth or Kingston, since called St. Edmundsbury from "bury" in Anglo-Saxon, which means court or place, and this town was Edmund's own patrimony. Consult: Lambert, 'Topographical Dictionary of England.'

**Edmund, Saint**, Archbishop of Canterbury: b. Abingdon, England, about 1190; d. Soissy, France, 16 Nov. 1240. His parents, Reynold and Mabilia Rich, who lived in humble circumstances, were noted for their piety. His first studies were made at Oxford, and from there he was sent to Paris, from which school he returned home at the death of his mother; but remained in England only long enough to attend to placing his sisters in good homes. After returning to Paris he devoted himself to the study of theology and the Scriptures, and for a time taught the Scriptures in Paris. Returning to England, after his ordination, he became a teacher at Oxford from 1219 to 1226; he was the first who taught Aristotle's logic at Oxford. He desired to work among the poor, and at his own request was transferred to Salisbury Cathedral. While at Salisbury he received a commission from the Pope to preach the crusade against the Saracens, which he did with the result that not only many of his hearers joined the crusade, but numbers became exemplary Christians. William, surnamed Longspear, the famous Earl of Salisbury, through the preaching and instruction of Edmund reformed his life and became active in good works.

Edmund had great power in teaching how to pray; he often said: "A hundred thousand persons are deceived in multiplying prayers: I would rather say five words devotedly with my heart, than five thousand that my soul does not relish with affection and understanding. 'Sing to the Lord Wisely.'"

In 1234 Pope Gregory IX. appointed Edmund as Archbishop of Canterbury. The chapter of Canterbury was unanimous in his favor and the appointment was pleasing to the king, Henry III., but when Edmund was informed of the "honors heaped upon him," he at first refused to listen to the committee appointed to wait upon him. He assured them that they were mistaken, and if not that he would not consent to become Archbishop of Canterbury. The bishop of Salisbury went to him and induced him to accept the office, and he was consecrated Archbishop of Canterbury on 2 April 1234. He at once entered upon a series of reforms in courts, monasteries, and among his clergy. Adversaries arose among those who ought to have been his advocates. His 'Constitutions' in 36 canons, dealing with matters of reform, are still extant. Troubles arose between Edmund and the king, when the king's greed sought various means to secure Church revenues. Both the archbishop and the king appealed to the Pope, who, failing to finally settle the disputes, left the archbishop almost powerless to cope with his adversaries. Fearing that by remaining he

might seem to sanction what he could not redress, he left the country secretly and went to France, where he received a warm welcome.

The testimony of his sanctity and miracles were so numerous that he was canonized in 1246, only four years after his death. Some of his works extant are: 'Constitutions,' to be found in 'Editions of the Councils' by Linwood, Spelman, Wilkins, Johnson, and Labbe; 'Speculum Ecclesiæ,' or 'Mirror of the Church'; and several of his works in manuscript, one on the Sacraments, are in the Bodleian library, Oxford. Consult: Wood, 'History and Antiquity'; Tanner, 'Notitia Monastica'; Butler, 'Lives of Saints.'

**Edmund I., or Eadmund,** king of England: b. about 921; d. 26 May 946. He was a son of Edward the Elder and succeeded his brother Athelstan in 940. He subdued Northumbria and the Five Danish Boroughs in 944, and in the following year conquered Cumbria, which he bestowed on Malcolm, king of Scotland, on condition of homage. He was killed at a banquet by Liofa, an outlaw.

**Edmunds, George Franklin,** American lawyer: b. Richmond, Vt., 1 Feb. 1828. He received a common school education, as well as the instructions of a private tutor; studied law, and began its practice in 1849. In 1851 he removed to Burlington, Vt. He was a member of the Vermont legislature 1854-9, being speaker 1856-9, and was a member of the State Senate, and its president 1861-62. He was by this time very prominent in Vermont politics, and at the opening of the Civil War, when a State convention assembled with the intention of uniting war Democrats and Republicans, he outlined the resolutions which the convention finally adopted as the principles of union. On the death of Solomon Foot, in 1866, Edmunds was elected to the United States Senate to fill Foot's unexpired term, and was thrice re-elected for full terms, resigning in 1891. During his quarter-century in the National Senate he served on many important committees, displaying the qualities of an able, accomplished statesman. He was a member of the electoral commission in 1877, and was the author of the act of 22 March 1882 known as the "Edmunds Act" (q.v.), which provided for the suppression of polygamy in Utah and the disfranchisement of any person convicted of practising it. He was also the author of the "Anti-Trust Law" of 1890. During the term of President Arthur he was president *pro tempore* of the Senate. In 1897 he became chairman of the monetary commission which had been appointed by the executive committee of the Indianapolis monetary conference. Since his retirement from the Senate he has devoted himself to his profession, and has a wide fame as a constitutional lawyer.

**Edmund II., or Eadmund** (surnamed Ironside), king of England: b. about 981; d. 30 Nov. 1016. He was a son of Ethelred II., and on the latter's death in 1016 was chosen king at London, whilst Canute was elected to the same dignity at Southampton. Edmund several times defeated the forces of the Danish ruler, but was himself defeated at Assandun (now Ashington) in Essex. A compromise was then effected, by which the midland and northern counties were assigned to Canute and the southern to Edmund.

**Edmunds Act**, passed by Congress 22 March 1882; an act to root out polygamy in Utah, not only by direct punishment but by barring out votes, public careers, and official action from polygamists. Mormons held control of the Territory not only through the local offices, but from the fact that all juries were composed of Mormons who would not convict their fellows or admit evidence of polygamy; and the act not only disfranchised but excluded from juries all who either practised polygamy or believed it rightful. The disfranchisement was even more effective, as Utah had woman suffrage, and each polygamous wife was disfranchised also. The act made the living with more than one woman in marital relations a misdemeanor, and several leading Mormons were convicted, including their delegate to Congress; which office, as well as all from justice of the peace to probate judge or sheriff, was made inaccessible to polygamists.

**Edom, ʿēdôm,** in the New Testament **ΙΔΟΥΜΕΑ**, in ancient times a country lying to the south of Palestine. The Edomites are said in Genesis to be the descendants of Esau, who was also called Edom (a word signifying "red"), and who dwelt in Mount Seir, the mountain range now called Jebel Shera, stretching between the Dead Sea and the Gulf of Akabah. The Edomites were subdued by King David, and after the separation of the 10 tribes remained subject to the kingdom of Judah till the reign of Jehoram, when they revolted and secured their independence for a time. They were again subdued about half a century later by Amaziah and again in the reign of Ahaz, recovered their independence, which they maintained till the time of the invasion of Judea by Nebuchadnezzar. They fell under the rule of the Persians, and latterly their fortunes were merged in those of Arabia. The chief city in this region was Petra, which now presents remarkable ruins, rock-cut temples, and walls.

**Ed'red,** king of England: d. Frome, England, 23 Nov. 955. He was a son of Edward the Elder, and succeeded to the throne on the murder of his brother, Edmund I., in May 946. He quelled a rebellion of the Northumbrian Danes, and compelled Malcolm, king of Scotland, to renew his homage for his English possessions. Edred died after a reign of nine years, and left the crown to his nephew, Edwy.

**Edriophthalmata**, ed'ri-of-thäl'ma-ta, a name sometimes used for one of the great divisions of the *Crustacea*, including all those genera which have their eyes sessile, or embedded in the head, and not fixed on a peduncle or stalk, as in the crabs, lobsters, etc. These malacostracous *Crustacea* which were formerly included in this group are now generally called *Arthrostaca*, in which all of the thoracic segments, except the first and sometimes the second, are free from the head. It includes the orders *Amphipoda* or sand hoppers, whale lice, etc. (qq.v.), and the *Isopoda* or wood lice, pill bugs (qq.v.), and their aquatic allies, many of which are parasitic. A third order sometimes associated with these is the *Anisopoda* which includes small forms approaching the higher *Malacostraca* in several respects.

**Ed'risi.** See IDRISI, ABU ABDALLAH MOHAMMED.

**Edsall, Samuel Cook**, American Protestant Episcopal bishop: b. Dixon, Ill., 4 March 1860. He was educated at Racine College; became a lawyer in 1882, and later entered the Protestant Episcopal ministry and was graduated at the Western Theological Seminary in 1889. After several years of successful work as a pastor in Chicago he was elected missionary bishop of North Dakota in 1898, and was consecrated 25 Jan. 1899. He was translated to the diocese of Minnesota in June 1901, as coadjutor bishop, succeeding to the headship of the diocese on the death of Bishop Whipple a few months later.

**Edson, Cyrus**, American bacteriologist: b. Albany, N. Y., 8 Sept. 1857; d. 1903. He was graduated at the New York College of Physicians and Surgeons in 1881 and in the following year was appointed a sanitary inspector. In 1893-5 he was health commissioner of New York. He discovered a new treatment for consumption, malaria, and other germ diseases, in 1896, which he named *aseptolin*. His publications include about 80 papers on medical and sanitary subjects. He was the inventor of many surgical instruments.

**Education**, the developing of the human faculties; the imparting and acquiring of knowledge; technically the training of the young, physically, mentally, and morally. There are two recognized systems—discipline, or moral training, and instruction, or mental development. Under discipline are grouped self-control, obedience, civility, reverence, and the preservation of life, health and morals; under instruction come language and the arts, and the cultivation of taste, imagination, memory, and specific knowledge.

**Education in the United States.** Spontaneity is the keynote of education in the United States. Its varied form, its uneven progress, its lack of symmetry, its practical effectiveness, are all due to the fact that it has sprung, unbidden and unforced, from the needs and aspirations of the people. Local preference and individual initiative have been ruling forces. What men have wished for that they have done. They have not waited for State assistance or for State control. As a result, there is, in the European sense, no American system of education. There is no national educational administrative machinery and no national legislative authority over education in the several States. The bureau of education at Washington was not established until 1867, and save in one or two minor respects, its functions are wholly advisory. It is absolutely dependent upon the good will of the educational officials of the States, counties, and municipalities and upon that of the administrative officers of privately conducted institutions, for the admirable and authoritative statistics which it collects and publishes year by year. That these statistics are so complete and so accurate is evidence that the moral influence and authority of the bureau of education are very great, and that it commands a co-operation as cordial as it is universal.

**National Government and Education.**—But the national government has, from the very beginning, made enormous grants of land and

money in aid of education in the several States. The portion of the public domain hitherto set apart by Congress for the endowment of public education amounts to about 87,000,000 acres, or 135,938 English square miles. This is an area larger than that of the six New England States, New York, New Jersey, Maryland, and Delaware added together. It is a portion of the earth's surface as great as the kingdom of Prussia, about seven tenths as great as France, and considerably greater than the combined areas of Great Britain, including the Channel Islands, and the kingdom of Holland. The aggregate value of lands and money given for education by the national government, as Commissioner Harris shows in detail, is nearly \$300,000,000.

**Education a State Function.**—The uniform tendency of recent development, as marked by judicial decisions and by legislative enactments, is to treat all publicly controlled education as part of a slowly forming system which has its basis in the authority of the State government, as distinguished from that of the nation on the one hand and from that of the locality on the other. This system may be highly centralized, as in New York, or the contrary, as in Massachusetts, but the theory underlying it is the same. The two fundamental principles which are emerging as the result of a century's growth are, first, that education is a matter of State concern, and not merely one of local preference; and, second, that State inspection and supervision shall be applied so as to stimulate and encourage local interest in education and to avoid the deadening routine of a mechanical uniformity. The State acts to provide adequate opportunity for elementary education for all children, and abundant opportunity for secondary and higher education. But the State claims no monopoly in education. It protects private initiative, whether stimulated by religious zeal, philanthropy or desire for gain, in doing the same thing. It is not customary, in the United States, for State officials to inspect or to interfere with the educational work of privately established institutions. When these are chartered bodies, they are subject simply to the general provisions of law governing corporations of their class. When they are not chartered bodies, the State treats them as it does any private business undertaking: it lets them alone. Standards of efficiency and of professional attainment are regulated in these institutions by those in neighboring public institutions, by local public opinion and by competition. Sometimes these forces operate to raise standards, sometimes to lower them. New York has gone farther than any other State in attempting to define and to classify all educational institutions, private as well as public. Pennsylvania has recently entered upon a similar policy; and it is being urged in other States as well. The public elementary schools are more or less carefully regulated by law, both as to length of school term, as to subjects taught, and as to the necessary qualifications of the teachers. The public secondary schools, familiarly known as high schools, and the State universities are usually without any such regulation.

**Statistics of Public Education.**—The term "common schools" is often used in the United



## EDUCATION IN THE UNITED STATES

States of the public elementary schools alone; but the more correct use is to include under it all public elementary schools,—the first eight years of the course of study,—and all public secondary schools, maintaining a four years' course, as a rule, in advance of the elementary school. In 1900-1 the total estimated population of the United States was 77,262,743. Of this number 21,897,678 were of school age, as it is called; that is, they were from 5 to 18 years of age. This is not the age covered by the compulsory education laws, but the school age as the term is used by the United States census. By school age is meant the period during which a pupil may attend a public school and during which a share of the public money may be used for his education. It is obvious, then, that persons who have satisfactorily completed both an elementary and a secondary course of study may still be returned as of "school age" and as "not attending any school." This fact has always to be taken into account in the interpretation of American educational statistics.

In 1900-1 the number of pupils entered upon the registers of the common schools—that is, the public elementary and the public secondary schools—was 15,603,451, or 20.20 per cent of the total population and 71.26 per cent of the persons of "school age." The total population of Scotland is only a little more than a third of this. For these pupils 430,004 teachers were employed, of which number 123,941 or 28.8 per cent were men. The women teachers in the common schools numbered 306,063. The teachers, if brought together in 1901 would have outnumbered the population of Sheffield, the women alone more than equaling the population of New Orleans. No fewer than 249,969 buildings were in use for common school purposes. The aggregate value of public school property was nearly \$577,000,000 (\$576,963,089).

The average length of the annual school session was 144.2 days, an increase since 1870 of 12 days. In some States the length of the annual school session is very much above this average. It rises, for example, to 191 days in Rhode Island, 185 in Massachusetts, 183 in New Jersey, 177 in New York, 165.02 in California, 160 in Iowa, 163 in Michigan, and 169 in Wisconsin. The shortest average annual session is in North Carolina (76.1 days) and in Alabama (78.3). Taking the entire educational resources of the United States into consideration, each individual of the population would receive school instruction for 5.14 years of 200 days each. Since 1870 this has increased from 3.36 years, and since 1880 from 3.96 years, of 200 days each.

The average monthly salary of men teachers in the common schools was \$47.55 in 1900-1; that of the women teachers was \$39.17. The total receipts for common school purposes in 1900-1 were almost \$235,000,000 (\$234,967,919), of which vast sum 4.2 per cent was income from permanent funds, 16.4 per cent was raised by State school tax, 68.6 per cent by local (county, municipal, or school district) tax, and 10.8 came from other sources. The common school expenditure per capita of population was \$2.93; for each pupil, it averaged \$21.14. Teachers' and superintendents' salaries absorb 63.2 per cent (\$142,776,168) of the expenditure for com-

mon schools. The commissioner of education believes the normal standard of enrollment in private educational institutions to be about 15 per cent of the total enrollment, though often decreased in periods of commercial and financial depression.

*Illiteracy.*—Illiteracy in the United States can hardly be compared fairly with that in European countries because of the fact that an overwhelming proportion of the illiterates are found among the negroes and among the immigrants who continue to pour into the country in large numbers. The 12th census of the United States, taken in 1900, showed that the percentage of illiterates to the whole population was 10.7, a decrease of 2.6 per cent since the census of 1890. But the percentage of illiterates among the native white population (74.4 per cent of the whole population) was only 4.6 per cent of those of 10 years of age or older. Among the foreign-born white population (13.4 per cent of the whole), the percentage of illiteracy was 12.9 per cent, and among the colored population (11.6 per cent of the whole) it was 44.5. That is, considerably over one half of the whole number of illiterates in the United States were colored. Only in Alabama, Arkansas, Georgia, Indian Territory, Kentucky, Louisiana, New Mexico, North Carolina, South Carolina, Tennessee, and Virginia was the percentage of illiteracy among the native white population greater than 10. This percentage fell below 2 in Washington (0.5), Montana (0.6), Nevada (0.6), South Dakota (0.6), Wyoming (0.7), Connecticut (0.8), District of Columbia (0.8), Massachusetts (0.8), Minnesota (0.8), Nebraska (0.8), Oregon (0.8), Utah (0.8), Alaska (0.9), Idaho (0.9), North Dakota (0.9), California (1.0), Iowa (1.2), New York (1.2), Kansas (1.3), Wisconsin (1.3), New Hampshire (1.5), Michigan (1.7), New Jersey (1.7), and Rhode Island (1.8).

*Education and Crime.*—It is not infrequently charged by those who have but a superficial knowledge of the facts, or who are disposed to weaken the force of the argument for State education, that one effect of the system of public education in the United States has been to increase the proportion of criminals, particularly those whose crime is against property. The facts in refutation of this charge are simple and indisputable. In the first place, it must be remembered that communities maintaining schools have higher standards as to what is lawful than communities without the civilization which the presence of a school system indicates, and that, therefore, more acts are held to be criminal and more crimes are detected and punished in a community of the former sort than in one of the latter. A greater number of arrests may indicate better police administration instead of any increase in crime. Again, where records have been carefully kept, it appears that the illiterate portion of the population furnishes from six to eight times its proper proportion of criminals. This was established for a large area by an extensive investigation carried on by the bureau of education in 1870.

The history of the past 50 years in the State of Massachusetts is alone a conclusive answer to the contention that education begets crime. In 1850 the jails and prisons of that State held

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8,761 persons, while in 1855 the number had increased to three times as many (26,651). On the surface, therefore, crime had greatly increased. But analysis of the crimes shows that serious offenses had fallen off 40 per cent during this period, while the vigilance with which minor misdemeanors were followed up had produced the great apparent increase in crime. While drunkenness had greatly fallen off in proportion to the population, yet commitments for drunkenness alone multiplied from 3,341 in 1850 to 18,701 in 1885. The commitments for crimes other than drunkenness were 1 to every 183 of the population in 1850 and 1 to every 244 of the population in 1885. In other words, as has been pointed out, persons and property had become safer, while drunkenness had become more dangerous—to the drunkard.

The American people are convinced that their public school system has justified the argument of Daniel Webster, made in 1821: "For the purpose of public instruction," he said, "we hold every man subject to taxation in proportion to his property, and we look not to the question whether he himself have or have not children to be benefited by the education for which he pays; we regard it as a wise and liberal system of police, by which property, and life, and the peace of society are secured. We seek to prevent, in some measure, the extension of the penal code by inspiring a salutary and conservative principle of virtue and of knowledge in an early age. We hope to excite a feeling of respectability and a sense of character by enlarging the capacities and increasing the sphere of intellectual enjoyment. . . . Knowing that our government rests directly upon the public will, that we may preserve it we endeavor to give a safe and proper direction to the public will. We do not, indeed, expect all men to be philosophers or statesmen; but we confidently trust . . . that by the diffusion of general knowledge, and good and virtuous sentiments, the political fabric may be secure as well against open violence and overthrow as against the slow but sure undermining of licentiousness."

*Education and Industry.*—Where the public school term in the United States is longest, there the average productive capacity of the citizen is greatest. This can hardly be a coincidence. When the man of science finds such a coincidence as this in his test tube or balance, he proclaims it a scientific discovery proved by inductive evidence. According to a calculation made a few years ago, when the proportion between the school period in Massachusetts and the school period in the whole United States was as 70 to 43, it was found that the proportion between the productive capacity of each individual in Massachusetts and that of each individual in the whole United States, was as 66 to 37. Education, 70 to 43; productivity, 66 to 37. On the basis of 306 working days in Massachusetts, and on the basis of a population something over 2,000,000, this meant that every citizen of Massachusetts—man, woman, infant in arms—was to be credited with a productive capacity every year of \$88.75 more than the average for the United States as a whole. Or to put it in the most striking fashion, it meant that the excess of productive capacity for the State of Massachusetts in one year was \$200,000,000, or about

20 times the cost of maintaining the public schools. If the State of North Carolina, for example, could bring it about through education that every individual's productive capacity was increased 10 cents a day—that is, just one third the Massachusetts excess—for 306 working days, estimating the present population roughly at 1,900,000, the State would be better off in the next calendar year to the amount of more than \$58,000,000. North Carolina now spends less than \$1,000,000 a year for public education.

*Public Secondary Education.*—The number of public secondary schools, high schools, in the United States in 1900-1 was 6,318, employing 21,778 teachers and enrolling 541,730 pupils. The rapid increase of these schools, the flexibility of their programme of studies and the growing value of the training which they offer, are among the most significant educational facts of the last two decades. The rate of increase of secondary school pupils between the 11th and the 12th census was greater than the rate of increase of the population. It is noteworthy, too, that nearly 50 per cent of the whole number of secondary school pupils are studying Latin. In the public high schools the number equals 50.45 per cent.

Between 1890 and 1896, while the number of students in private secondary schools increased 12 per cent, the number of students in public secondary schools increased 87 per cent. Further, since 1893-4 the number of pupils in private secondary schools has steadily declined, the decrease in 1900-1 being 6.12 per cent as compared with the previous year; while the increase in public secondary schools was 5.34 per cent.

*Local Influence of the College.*—The number of universities and colleges in the United States—473, excluding those for women only—is very large. Many of these institutions, small and weak, ill-equipped and ill-endowed, are frequently criticised severely for endeavoring to continue the struggle for existence. This criticism is, in part, justifiable, but it ought not to be forgotten that almost every college exerts a helpful influence upon the life of its locality. The fact is frequently overlooked that all American colleges depend for their students in large measure upon their own neighborhood. Few draw from the nation at large, and these few draw only a small proportion of their students from beyond the confines of their own State or the limits of their own section of the country. In some cases the percentage of students who are residents of the State in which they attend college is from about 95 per cent to nearly 100 per cent.

*American Universities.*—The development of universities in the United States has taken place during the present generation. The name "university" is, in America, no proper index to the character and work of the institution which bears it. Prof. Perry has set out illustrations of this fact with great clearness. Nevertheless, the distinctions between secondary school, college and university are more widely recognized each year and it is not too much to hope that, in course of time, the various institutions will adopt the names which properly belong to each.

The definition of a university which I have suggested elsewhere is this: "An institution,

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where students, adequately trained by previous study of the liberal arts and sciences, are led into special fields of learning and research by teachers of high excellence and originality; and where, by the agency of museums, laboratories, and publications, knowledge is conserved, advanced, and disseminated." In this sense there are at least half a dozen American universities now in existence, and as many more in the process of making. These universities are markedly different from those of France, Germany, and Great Britain, but they respond in a most complete way to the educational needs of the American people, and they are playing an increasingly important part in the advancement of knowledge and the development of its applications to problems of government, of industry, and of commerce. The administrators of American universities have studied carefully the experience of European nations, and they have applied the result of that experience, wherever possible, in the solution of their own problems.

*Literature of Education.*—The variety and value of American contributions to the literature of education are worthy of notice. About 250 periodical publications of one type or another are devoted mainly to education. A few of these rank with the leading educational journals of the world. Perhaps the publications of the National Educational Association, a voluntary organization of teachers of every grade, are the most characteristic American contributions. They include not only the invaluable series of annual 'Proceedings,' containing papers and discussions by the leaders of American education for a generation, but reports upon particular subjects the investigation of which has been undertaken from time to time by special committees. Among the subjects so reported upon are these: Secondary School Studies, Organization of Elementary Education, Rural Schools, College Entrance Requirements, Relation of Public Libraries to Public Schools, and Normal Schools.

The most valuable official publications are these: the annual reports, issued since 1868, by the United States commissioner of education, those since 1889 being particularly noteworthy; the reports issued by Horace Mann as secretary of the State board of education of Massachusetts, 1838-49; the 12 volumes of reports issued by William T. Harris, as superintendent of the public schools of St. Louis, Mo., 1867-79; and the annual reports of Charles W. Eliot as president of Harvard University, 1871-99. The annual reports of State and city superintendents of schools are a storehouse of information and often contain elaborate discussions of educational theory and practice.

*Private Aid to Education.*—One fact in American education is certainly unique. That is the vast sum given in aid or endowment of education by individuals. It recalls the best traditions of the princes and churchmen of the Middle Ages, but is on a vastly larger scale. For some time past the income of Harvard University from this source has been nearly or quite \$1,000,000 annually. In 1898-9 the total amount of gifts to Harvard University for purposes of general or special endowment was \$1,383,460.77, and for immediate use \$161,368.90. In 1900-1 Chicago University received \$2,575,492

and Washington University (St. Louis) \$3,450,000. Columbia University received in one decade \$6,736,482 in money and in land. An unofficial estimate of the amount given by individuals during the year 1899 for universities, colleges, schools, and libraries was over \$70,000,000. The total amount of benefactions reported for 1900 by the various institutions for higher education was \$18,040,413. The tendency which these colossal figures indicate is one of the most fortunate and most hopeful in American life. The makers and holders of great fortunes are pouring out from their excess for the development of the higher life and greater productive capacity of the people. The religious bodies, in particular the Roman Catholic Church, are doing the same thing upon a very large scale. The conviction that education is fundamental to democratic civilization is perhaps the most widespread among the American people. Public funds and private wealth are alike given unstintingly in support of it.

*Study of Education.*—Education, conceived as a social institution, is now being studied in the United States more widely and more energetically than ever before. The chairs of education in the great universities are the natural leaders in this movement. It is carried on also in normal schools, in teachers' training classes, and in countless voluntary associations and clubs in every part of the country. Problems of organization and administration, of educational theory, of practical procedure in teaching, of child nature, of hygiene and sanitation, are engaging attention everywhere. Herein lies the promise of great advances in the future. Enthusiasm earnestness and scientific method are all applied to the study of education in a way which makes it certain that the results will be fruitful. The future of democracy is bound up with the future of education. See EDUCATIONAL ORGANIZATION AND ADMINISTRATION; STUDY OF EDUCATION.

**Education, Agricultural.** See AGRICULTURAL EDUCATION.

**Education, Board of, United States.** Established 1867 independently this was made a bureau of the interior department in 1868. Its function is to collect statistics of educational conditions and progress throughout the Union, and diffuse information on school systems and methods of teaching. Up to 1900 it had published 360 books and pamphlets. The first commissioner for whom in recognition of his immense and gratuitous educational work the office was created, was Henry Barnard of Connecticut; the present one (since 1889) is William T. Harris, originally of Connecticut.

**Education, Commercial.** See COMMERCIAL EDUCATION.

**Education, Compulsory.** This subject embraces compulsory attendance on the part of the child, and compulsory preparation on the part of the teacher. History shows that from the earliest ages, laws making education compulsory, under certain conditions, have been in existence. The Greeks, Romans, and others of the oldest civilized nations, or forms of government, had most rigorous laws regarding military education; as the Spartans going so far as to

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regulate the food and the dress of the male children, in order to make the bodies of the youths have greater power of endurance, and thus fit them for being defenders and protectors of the state. The nature of the education depended upon the environment as much as upon hereditary laws and customs. As conditions changed it was easy to pass from laws making military education compulsory to laws making compulsory the study of other subjects deemed essential to the welfare of the state.

There has never in any nation been unanimity of opinion regarding the right of the state to make and enforce compulsory education laws. The question in some form or degree has always presented itself: "Does the child belong to the parents or to the state?" Another question, co-ordinate with the one mentioned, has also given rise to much discussion among the friends and opponents of state compulsory education laws, is: "Shall the child be educated for the benefit of the parents or the state, or in such a manner as shall best develop his own natural powers regardless of the relation to parents or the state?" Another question which underlies both is: "What is the law by which the Creator works; and what are the laws He has imposed upon all things created?" These questions are complicated and far-reaching; but their solutions are essential for the line of argument to be followed in determining the needs and rights for making education, in some form, compulsory; and also in deciding who shall make the laws and by whom and how they shall be executed.

Compulsory education laws usually necessitate free schools; although in the United States the order of development has been the reverse of that followed in most European countries. In the United States generally the free school came first, and for the sake of the development of the individual, with society in the background, and the race not a factor. The compulsory legislation followed the free school. In European countries generally the compulsory laws came first, and the free school (not an eleemosynary school) followed. Under the old condition of things, the youth had to learn something to make him of value to the state, and in time the school in which he must learn had to be provided for him. The evolution from the camp, and the rush bed of the Spartan, and from the training for the athlete and the warrior to the elementary schools and colleges of to-day, is not difficult to follow, as mighty changes made needs and wants of nations different from the past. Prussia, Saxony, Württemberg, Baden, and other places made education compulsory early in the general movement. Later all of Germany, Holland, and other European countries followed. In 1876 a compulsory attendance law was enacted for certain schools in Great Britain and Ireland; but until 1880 "the matter of making by-laws compelling school attendance was optional with district boards, or school attendance committees. The law passed in 1880 empowered the educational department to make compulsory by-laws for all school districts where local authorities failed to take such action. Parents and employers violating the law are punished by fine and imprisonment."

In Switzerland attendance at elementary schools is compulsory in every canton. The

length of time attendance is required varies from six to nine years, in the different cantons. In the cantons of Bern and Solothurn girls are required to attend industrial and domestic science schools for one year after completing the regular elementary course. In the canton of Thurgovie girls must attend eight years day school, and additional two years singing and industrial school. In all the cantons of Switzerland, instruction in knitting, sewing, darning, embroidering, etc., is given to girls, and although the law does not make those studies compulsory in all places, they are all studied.

In the United States, the agitation regarding compulsory education laws began almost with the establishment of the school, and in nearly every State, the law regulating the establishment and support of schools by some form of general taxation was followed by the compulsory education law. As the "child labor" question became prominent, compulsory education forced itself more and more upon public attention. In 1647 Massachusetts made a law regarding the compulsory attendance of children at school, Kent (Vol. II., p. 196) says: "The compulsory system upon parents and masters to teach their children and servants to read, was enforced by fine in Massachusetts, by act of 1642, and in Plymouth colony laws in 1671." In the Massachusetts records mention is made of some "people of the town of Dedham who were indicted, tried, convicted, and fined for neglecting to keep and support a grammar school."

For various reasons, not the least of which were the changes made by the Revolutionary War, the 17th century compulsory education laws of Massachusetts became dead laws. At the session of the Massachusetts legislature in 1852, a general compulsory education law was passed, the first law of the kind passed in America after the 17th century laws which had become obsolete and ineffective. This Massachusetts law of 1852 applied to children between the ages of 8 and 14 years, and covered only 12 weeks of each school year, only six of which had to be consecutive. The penalty inflicted upon the parent or guardian neglecting to have a child comply with the law, did not exceed a fine of \$20, and no imprisonment. The child was not obliged to attend a public school, "but must be furnished with the means of education for a like period of time," or the child might be entirely exempt from attendance if he had "already acquired those branches of learning which are taught in common schools." Defective children were exempt from obedience to this law. To the town treasurer was given the authority to execute this law; but like the 17th century law, its enforcement was neglected, and its efficiency was never really tested.

The modern movement toward compulsory education in the United States has been influenced by all the causes which existed in the past, and in addition the new phases of the "child labor" and street education questions. Riis says: "Three fourths of all juvenile delinquency in New York is the result of truancy and the street life of children." New York State, early in the movement passed laws compelling attendance at school, but the penalty was not sufficient to make the breaking or neglecting of the law a serious matter. Under the revised statutes with duly authorized truant

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officers, and truant schools, the law is practically enforced. The child may attend any school or may be instructed by any one except in two cases. When the pupil desires to secure a scholarship in Cornell University attendance at a public school the six school months previous is necessary to make him eligible. To be eligible for a position as teacher in any city in the State of New York attendance and graduation from a State normal school or training class, or three years' successful experience is required. The law thus specifies the schools which the pupil must attend in the cases mentioned.

In 32 States and Territories of the United States there are laws regulating the compulsory school attendance of minors. The child is compelled to attend the whole school year or a specified number of weeks. The age limits vary from 6, 7, and 8, on the one side, to 14, 15, and 16 on the other, except in Wyoming where all under 21 years must attend school 12 weeks in each year. The penalties on parents and guardians for neglect to comply with the law, are in fines from \$2 to \$200 and imprisonment and in some cases forfeiture of public school money by school districts not enforcing the law.

The truancy laws are becoming more rigid in the United States. (See TRUANT SCHOOL.) The laws regarding the compulsory preparation of the teacher have kept pace with the laws regarding compulsory attendance. See TEACHERS, PROFESSIONAL TRAINING OF; COLLEGES FOR TEACHERS.

Consult: Reports of U. S. Commissioner of Education; Reports of State Superintendents of the United States; Reports of State Departments of different European countries.

**Education, Elementary.** In all the schools of the United States, public and private, elementary, secondary and higher, there were enrolled in the year 1899-1900 about 17,500,000 pupils. The actual average attendance for each pupil in the public or common schools did not exceed 98 days, although the average length of the school session was 1,446 days.

Out of this entire number deduct the pupils of private and parochial schools of all kinds, elementary, secondary, higher, and schools for art, industry and business, for defective classes and Indians, there remain over 15,300,000 for the public school enrolment, or nearly 90 per cent of the whole. The great growth of public schools in the last 30 years may be gathered from a 60 per cent increase in the cost of common schools, owing to better apparatus and more commodious school buildings, but especially to longer terms and higher salaries to teachers. The effect of the great increase of railways in the same period is to extend the suburbs of cities and vastly increase the urban population. The rural schools in sparsely settled districts still continue their old practice of holding a winter school with a session of 60 to 80 days only, and taught by the makeshift teacher who works at some other employment for two thirds of the year. The school year of ideal length should be about 200 days, or five days per week for 40 weeks, that is, nine and one half months. In the early days of city schools the attempt was made to hold a session of over 46 weeks in length, allowing only six weeks or less for three short vacations. But experience of their advantage to the pupil has led to the increase of the holidays to nearly double the former amount.

The average schooling, it appears from the above showing, amounts to enough to secure for each person a little more than one half of an elementary school course of eight years,— enough to enable the future citizen to read the newspaper, to write fairly well, to count, add, subtract, multiply and divide, and use the simplest fractions. In addition he acquires a little geographical knowledge, so important to enable him to understand the references or allusions in his daily newspaper to places of interest in other parts of the world. But the multiplicity of cheap books and periodicals makes the life of the average citizen a continuation of school to some extent. The transformation of an illiterate population into a population that reads the daily newspaper, and perforce thinks on national and international interests, is thus far the greatest good accomplished by the free public school system of the United States. That this general prevalence of elementary education is accompanied by a comparative neglect of the secondary and higher courses of study is evident from the fact that out of the number of pupils enrolled more than 95 in every 100 are pursuing elementary studies; less than 4 in 100 are in secondary studies in high schools, academies and other institutions; only 1 in 100 (13 in 1,000) is in a college or a school for higher studies.

In considering the reasons for the increase of the length of the term of the elementary school and its adoption of a graded course of study, one comes upon the most important item of improvement that belongs to the recent history of education, namely, the introduction of professionally trained teachers. The first normal school established in the United States was founded at Lexington, Mass., in 1839. The number of public normal schools supported by the State or municipal governments has increased since that year to nearly 200, and there is about an equal number of private normal schools. In 1880 there were 240 normal school students in each 1,000,000 of inhabitants; in 1897 there were 936, or nearly four times as many in each 1,000,000. The professionally educated teacher finds his place in the graded schools, and he continues to improve in skill and efficiency for many years. The advantage of the professionally educated teacher above others is to be found in the fact that he has been trained to observe methods and devices of instruction. The normal school graduate, too, other things being equal, has a better idea than other teachers of the educational value of a branch of study. He knows what points are essential, and what are accidental and subsidiary. He therefore makes his pupils thoroughly acquainted with those strategical positions, and shows him how to conquer all the rest through these.

As it would appear from the statistics given, the rural districts are precluded by their short school terms from securing professional teachers. The corps of teachers in a highly favored city will be able to claim a large percentage of its rank and file as graduates of its municipal training schools—perhaps 50 to 60 per cent; but the cities and villages as a whole in their graded schools cannot as yet show an average of more than one teacher in four who has received the diploma of a normal school. Another important advantage has been named as belonging to the schools of the village or city. They are graded schools, and have a regular



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course of study, uniformity of text-books, and a proper classification of pupils. In the small rural schools some 20 to 50 pupils are brought together under one teacher. Their ages vary from 4 years to 20, and their degree of advancement ranges from beginners up to those who have attended school for 10 or 12 winters, and are now attempting Latin and algebra. It often happens that there is no uniformity of text-books, except perhaps in the spelling-book and reader, each pupil bringing such arithmetic, geography or grammar as his family at home happens to possess. This was the case in the old-time district school—such as existed in 1790, when 29 out of 30 of the population lived in rural districts, and 50 years later when only 1 in 12 lived in a city. As the railroad has caused villages to grow into cities, so it has virtually moved into the city a vast population living near railway stations in the country by giving them the morning newspaper and rapid transportation. In 1890 one third of the population was living in cities of not less than 8,000 inhabitants. But the suburban populations made urban by the railroad swell the city population to one half of the whole nation. Hence the great change now taking place in methods of building school-houses and in organizing schools.

With the growth from the rural to the urban condition of population the method of "individual instruction" has been supplanted by class instruction, which prevails in village and city schools. The individual did not get much instruction under the old plan, for the simple reason that his teacher had only 5 or 10 minutes to examine him on his daily work. In the properly graded school each teacher has two classes, and hears one recite while the other learns a new lesson. Each class is composed of 20 to 30 pupils of nearly the same qualifications as regards the degree of progress made in their studies, and all pupils learn more by a class recitation than by an individual recitation, for in the class each can see the lesson reflected in the minds of his fellow pupils, and understand his teacher's views much better when drawn out in the form of a running commentary on the mistakes of the duller or more indolent pupils. The possibilities of a class recitation are, therefore, very great for efficient instruction in the hands of a teacher who understands his business. From beginning to end, for 30 minutes, the class recitation is a vigorous training in critical alertness. The pupil afterward commences the preparation of his next lesson from the book with what are called new "apperceptive" powers, for he finds himself noticing and comprehending many statements and a still greater number of implications of meaning in his lesson that before had not been seen or even suspected.

It is presupposed that the chief work of the pupil in school is the mastery of text-books containing systematic treatises giving the elements of branches of learning taught in the schools. The evil of memorizing words without understanding their meaning or verifying the statements made in the text-book is incident to this method and is perhaps the most widely prevalent defect in teaching to be found in the schools of the United States. The oral method of Germany escapes this evil almost entirely, but encounters another. The pupil taught by the oral method exclusively is apt to lack power to master

the printed page and get out of it the full meaning; he needs the teacher's aid to explain the technical phrases and careful definitions. The American method of text-book instruction throws the child upon the printed page and holds him responsible for its mastery. In the hands of a trained teacher the good of the method is obtained and the evil avoided. The pupil is taught to assume a critical attitude toward the statements of the book and to test and verify them, or else disprove them by appeal to other authorities, or to actual experiments.

In the graded school the pupil is held responsible for his work in a way that is impossible in the rural school of sparsely settled districts. Hence the method of investigation, as above described, is found in the city schools rather than in the rural schools. Where the ungraded school makes some attempt at classification of pupils it is obliged to unite into one class say of arithmetic, grammar, or geography, pupils of very different degrees of progress. The consequence is that the most advanced pupils have not enough work assigned them, being held back to the standard of the average. It must be admitted that in many village schools just adopting the system of grading, this evil of holding back the bright pupils and of over-pressure on the dull ones exists, and furnishes just occasion for the criticism which is made against the so-called "machine" character of the American public school. I have dwelt on this somewhat technical matter because of its importance in understanding the most noteworthy improvements in progress in the schools of the United States. Briefly, the population is rapidly becoming urban, the schools are becoming "graded." Here there is division of labor on the part of teachers, one taking only classes just beginning to learn to read and write, another taking the pupils in a higher grade. The inevitable consequence of such division of labor is increase of skill. The complaint urged against the machine character of the modern school is made quite as often against good schools as against poor ones. But the critical-probing method of conducting a recitation is certainly not machine-like in its effects. It arouses in the most powerful manner the activity of the pupil to think and observe for himself. It is admitted that about 50 per cent of the teachers actually teaching in the schools of villages and cities use this poor method. But it is certain that their proportion in the corps of teachers is diminishing, thanks to the two causes already alluded to: first, the multiplication of professional schools for the training of teachers; and second, the employment of educational experts as supervisors of schools.

Another phase of the modern school that more than anything else gives it the appearance of a machine is its discipline, or method of organization and government. In the graded school with 300 to 800 pupils order and discipline are necessary down to the last particular, for the safety of the pupils as well as for the accomplishment of the ends for which the school exists. There must be regularity and punctuality, silence and conformity to order, in coming and going. These things seem at first to be so much waste of energy. But the moment the question of moral training comes to be investigated, the superiority of the education given in the large school is manifest. The pupil is taught to be regular and punctual in his attendance on school



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and in all his movements, not for the sake of the school alone, but for all his relations to his fellow men. He learns to respect the serious business of others. In moving to and fro by a sort of military concert and precision he acquires the impulse to behave in an orderly manner, to stay in his own place and not get in the way of others. Hence he prepares for concerted action,—another important lesson in citizenship, leaving entirely out of account its military significance. With the increase of cities and the growth of great industrial combinations this discipline in the virtues that lie at the basis of concerted action is not merely important, but essential. Precision, accuracy, implicit obedience to the head or directive power, are necessary for the safety of others and for the production of any positive results. The rural school does not fit its pupils for an age of productive industry and emancipation from drudgery by means of machinery, but the city school performs this so well that it reminds some people unpleasantly of a machine.

In the matter of school discipline again the graded school has an advantage over the school of the rural district. A corps of teachers can secure good behavior more efficiently than a single teacher. The system, and its very "mechanism," help this result. In many cities of the largest size in the United States, corporal punishment is seldom resorted to, or is entirely dispensed with, and the discipline of the school seems to improve as a result. The adoption of a plan of building giving each class-teacher a room to herself, in which pupils to the number of 50 or so prepare their lessons under the eye of the same teacher that conducted their recitations makes it possible to manage a school with little or no corporal punishment. That the public schools of cities have worked great and favorable changes to the advantage of civil order cannot be doubted. They have generally broken up the feuds that used to prevail between the people of different precincts. Learning to live without quarreling with school-fellows is an efficient preparation for an orderly and peaceful life with one's neighbors. It is a stronger moral force than the rural school because of its superior training in the social habits named—regularity, punctuality, orderly concerted action and self-restraint.

Even in colonial times as far back as 1642 a compulsory law was enacted in Massachusetts inflicting penalties on parents for the neglect of education.

In the Connecticut colony in 1650 the Massachusetts law was adopted. Amendments were adopted in 1805 and 1821. By a law of 1813 manufacturing establishments were compelled to see that "the children in their employ were taught to read, write and cipher, and that attention was paid to their morals." In 1842 a penalty was attached to a similar law which forbade "the employment of children under the age of 15 years unless they had been instructed at school at last 3 months of the 12 preceding." At the present 30 States, one Territory and the District of Columbia have laws making education compulsory, generally at a public or approved private school. Sixteen States and one Territory do not make education compulsory, although all of these have fully organized systems of schools free to every child of school age of whatever condition. The most general period of required attendance

at school is from 8 to 14 years of age, as is the case in Vermont, District of Columbia, West Virginia, Indiana, Michigan, North Dakota, South Dakota, Nebraska, Kansas, Montana, Colorado, Utah, Nevada, Idaho, Oregon and California. It begins likewise at 8, but is extended to 15 in Maine and Washington, and is from 8 to 16 in New Hampshire, Connecticut, New York, Pennsylvania, Minnesota and New Mexico. The child is required to begin attendance at the earlier age of 7, and continue to 12 in New Jersey, to 13 in Wisconsin, to 14 in Massachusetts, Kentucky and Illinois; to 15 in Rhode Island, and to 16 in Wyoming. In Massachusetts and Connecticut the child is required to attend the full time that the schools are in session; in New York and Rhode Island, also, the full term, with certain exceptions in favor of children employed to work. In Pennsylvania the attendance is required for 70 per cent of the full term; in California for 66 2-3 per cent; for 20 weeks annually in Vermont, New Jersey, Ohio and Utah; 16 weeks annually in Maine, West Virginia, Illinois, Michigan and Nevada; 12 weeks annually in New Hampshire, District of Columbia, Indiana, Wisconsin, Kansas, North Dakota, South Dakota, Nebraska, New Mexico, Idaho, Washington, Oregon; and 8 weeks annually in Kentucky. Massachusetts requires counties, and New York requires cities to maintain truant schools, or provide for their truants in the truant schools of neighboring localities. Illinois requires cities of over 100,000 inhabitants to maintain truant schools. In Rhode Island towns and cities must provide suitable places for the confinement and instruction of habitual truants. Clothing is furnished in case of poverty to enable children to attend school in Vermont, Indiana and Colorado.

In both the central and the western divisions the education of boys and girls in the same schools is common and exceptions rare in the public schools. In the North and South Atlantic divisions many of the older cities continue to educate the girls in separate schools. In newly added suburban schools, however, coeducation is the rule (as in Boston, for example). In the rural districts of the Atlantic divisions north and south, coeducation has always been the custom. Considering the whole country, it may be said that coeducation, or the education of boys and girls in the same classes, is the general practice in the elementary schools of the United States. The cities that present exceptions to this rule are fewer, apparently, than 6 per cent of the total number. In the majority of these cities the separation of boys and girls has arisen from the position or original arrangement of buildings, and is likely to be discontinued under more favorable conditions. Of the 50 principal cities, four, namely, Philadelphia, Newark, Providence, and Atlanta report separation of the sexes in the high schools only; two cities of this class, San Francisco and Wilmington, reported in 1892, separation in all grades above the primary. In six cities, New York, Brooklyn, Boston, Baltimore, Washington and Louisville, both separate and mixed classes are found in all grades. Five cities of the second class, having a population of 8,000 or more, report separation of the sexes in the high schools, and 10 cities of the same group separate classes in other grades. Of cities whose population is less than 8,000, nine report

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separate classes for boys and girls in some grades. Coeducation is the policy in about two thirds of the total number of private schools reporting to this bureau, and in 65 per cent of the colleges and universities.

In connection with this matter of State compulsory laws against neglect of schools it is well to mention the provisions made in the several States prohibiting appropriations of money to aid denominational schools. There are 40 States with constitutional provisions forbidding all, or at least sectarian, diversion of the money raised for the support of education.

1. *Constitutions which prohibit sectarian appropriations.*—California, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, New Hampshire, North Dakota, Oregon, South Dakota, Texas, Washington, Wisconsin, Wyoming—21 States.

2. *Constitutions which do not prohibit sectarian appropriations.*—Alabama, Arkansas, Connecticut, Delaware, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Nebraska, Nevada, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia—23 States.

3. *Constitutions which prohibit any diversion of the school fund.*—Alabama, Arkansas, California, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Washington, West Virginia, Virginia, Wisconsin—36 States.

Manual training is by no means a novelty in American schools. Thomas Jefferson recommended it for the students of the University of Virginia, and Benjamin Franklin included it in his plan for an academy in Philadelphia. An active propaganda was carried on in behalf of manual labor in educational institutions for many years, beginning about 1830, and some of our foremost institutions had their origin under its influence. But what is now known as "manual training" is traced to an exhibit of a Russian institution at the Centennial Exposition in 1876. The value of the system of hand training there suggested was recognized by such men as John D. Runkle and C. M. Woodward, who became advocates of the new idea and introduced it into the institutions under their charge. Strong opposition was met among schoolmen for a time, but manual training has steadily grown in popularity, and with its growth it has constantly improved in matter and method, and consequently in usefulness. In 1898 manual training was an essential feature in the public school course of 149 cities. In 359 institutions other than city schools there is training which partakes more or less of the nature of manual training, and which belongs in a general way to the same movement. These institutions embrace almost every class known to American education, and the manual features vary from the purely educational manual training of the Teachers College in New York city to the specific trade instruction of the apprentice schools. In many cases the legislatures have taken cognizance of the movement. Massachusetts requires every city of 20,000 in-

habitants to maintain manual training courses in both elementary and high schools. Maine authorizes any city or town to provide instruction in industrial or mechanical drawing to pupils over 15 years of age; industrial training is authorized by general laws in Connecticut, Illinois, Indiana (in cities of over 100,000 population), Maryland, New Jersey, New York, Pennsylvania, Utah, Wisconsin and Wyoming. Congressional appropriations are regularly made for manual training in the District of Columbia; Georgia authorizes county manual labor schools, and in Washington manual training must be taught in each school under the control of the State Normal school. See MANUAL TRAINING.

Kindergartens are authorized by general law in Arizona, California, Colorado, Connecticut, Illinois, Indiana, Iowa, Michigan, New York, Ohio, Oregon, Pennsylvania, Vermont and Wisconsin. Cities also establish kindergartens through powers inherent in their charters. In 1897-8 there were public kindergartens in 189 of the 626 cities of 8,000 population and over. In these 189 cities there were 1,365 separate kindergartens supported by public funds. The number of kindergarten teachers employed in this year was 2,532, and under their care were 95,867 children, 46,577 boys and 49,290 girls. Information was obtained concerning 2,998 private kindergartens in 1897-8 and it is probable that at least 500 others were in existence. The 2,998 private kindergartens had 6,405 teachers and 93,737 pupils. It will be seen that the total number of kindergartens, public and private, was 4,363, with 8,937 teachers and 189,604 pupils. The actual number of pupils enrolled in kindergartens in the United States in 1897-8 must have exceeded 200,000, as these reports were not exhaustive.

Education in the United States is regarded as something organic, and as belonging essentially to our political and social structure. We are making the experiment of self-government, and it has seemed a logical conclusion to all nations of all times that the rulers of the people should have the best education attainable. Then, of course, it follows that the entire people of a democracy should be educated, for they are the rulers. This necessity for education has been felt in all parts of the nation, and the whole subject is reasoned out in many a school report published by city or state. By education we add to the child's experience the experience of the human race. His own experience is necessarily one-sided and shallow; that of the race is thousands of years deep, and it is rounded to fulness. Such deep and rounded experience is what we call wisdom. To prevent the child from making costly mistakes we give him the benefit of seeing the lives of others. The successes and failures of one's fellow men instruct each of us far more than our own experiments. The school attempts to give this wisdom in a systematic manner. It uses the essential means for its work in the shape of text-books, in which the experience of the race is digested and stated in a clear and summary manner, in its several departments, so that a child may understand it. He has a teacher to direct his studies and instruct him in the proper methods of getting out of books the wisdom recorded in them. He is taught first in the primary school how to spell out the words and how to write them himself. Above all, he is taught to understand the meaning of the words. All first use of words reaches only a few of their

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many significations; each word has many meanings and uses, but the child gets at only one meaning, and that the simplest and vaguest, when he begins. His school work is to train him into accuracy and precision in the interpretation of language. He learns gradually to fill each word of the printed page with its proper meaning. He learns to criticise the statements he reads, and to test them in his own experience and by comparison with other records of experience. In other words, the child at school is set to work to enlarge his own puny life by the addition of the best results of other lives. This is the clue to the hopes founded on education. The work of the school produces self-respect, because the pupil makes himself the measure of his fellows and grows to be equal to them spiritually by the mastery of their wisdom. Self-respect is the root of the virtues and the active cause of a career of growth in power to know and power to do. Webster explained the effect of the school as exciting "a feeling of responsibility and a sense of character." Each youth educated in the school has been submitted to a training in the habit of self-control and of obedience to social order. He has become to some extent conscious of two selves; the one his immediate animal impulse, and the second his moral sense of conformity to the order necessary for the harmonious action of all. The statistics of crime confirm the anticipations of the public in regard to the good effects of education. The jails of the country show pretty generally the ratio of 8 to 1 as the quotas of delinquents furnished from a given number of illiterates as compared with an equal number of those who can read and write. And it is found on investigation that the criminals who can read and write are mostly from the ranks bordering on illiteracy. They may be described as *barely* able to read and write, but without training in the use of those arts for acquainting themselves with the experience and wisdom of their fellow men. Thus the political problem, which proposes to secure the general welfare by entrusting the management of the government to representatives chosen by all the people, finds its solution in the establishment of schools for the people.

All who become interested in the system of education prevailing in the United States and see the direct bearing it has on the realization of the ideal of self-government, feel an interest in the question of its origin. Immigrants to America in the colonial period laid stress on the establishment of schools. Education is called "the foundation of the commonwealth," in 1583, in a school law of Holland. At that time there was a stringent school law passed. In Sweden education was common before 1650, and every peasant's child was taught to read. Boston, in 1635, voted a school and funds to support a master. Roxbury was quite active in the founding of free schools. Plymouth, Weymouth, Dorchester, Salem, Cambridge, and other towns had schools before 1650. A law of the general court of Massachusetts decreed that in every town the selectmen should prosecute those who refused to "train their children in learning and labor," and to impose a fine of 20 shillings on those who neglected to teach their children "so much learning as may enable them perfectly to read the English tongue." Schools were established in the Connecticut colonies immediately after their settlement. The Rhode Island

colonies had schools by 1650. Meanwhile in New York the Dutch had brought over their zeal for education. The Dutch West India company, in 1621, charged its colonists to maintain a clergyman and a schoolmaster. It seems that in 1625 the colonial estimate included a clergyman at 1,440 florins, and a schoolmaster at 360 florins. In 1633 the first schoolmaster arrived—Adam Roelandson. His name is revered like that of Ezekiel Cheever and Philemon Purmont, schoolmasters of early Boston. New Jersey established schools as early as 1683, and an example of a permanent school fund is found in an appropriation made that year. In 1693 a law compelled citizens to pay their shares for the maintenance of a school. The original charter given William Penn required that the government of his colony should erect and aid public schools. Within 20 years after its settlement, schools were founded in Philadelphia, and others in towns of that colony.

Most of these schools mentioned were more truly secondary than elementary. See EDUCATION, SECONDARY.

The management of the district (elementary) schools began in most cases with the church and gradually came into the hands of the smallest political subdivision, known as "districts." Each township was divided into districts for school purposes, and for minor political purposes such as repair of the public highways. Each district contained an average of four square miles, with a school-house near the centre of population, usually a little distance from some village, and holding a maximum of 40 or 50 pupils. The school committee employed teachers. The schools held a three-months' session in the winter, and sometimes this was made four months. When the villages began to catch the urban spirit and establish graded schools with a full annual session, there came a demand for a higher order of teacher, the professional teacher, in short. This caused a comparison of ideals; the best enlightened in the community began an agitation of the school question, and supervision was demanded. In Massachusetts, where the urban civilization had made most progress, this agitation resulted in the formation of a state board of education of 1837, and the employment of Horace Mann as its secretary (June, 1837). Boston had been connected with Providence, Worcester and Lowell by railroads before 1835, and in 1842 the first great trunk railroad had been completed through Springfield to Albany, opening to Boston a communication with the great West by the Erie canal and the newly completed railroad from Albany to Buffalo. This was the beginning of the great urban epoch in America that has gone on increasing the power of the city to this day. Horace Mann came to the head of education in Massachusetts just at the beginning of the epoch of railroads and the growth of cities. He attacked with unsparing severity the evils of the schools as they had been. The school district system, introduced into Connecticut in 1701, into Rhode Island about 1750, and into Massachusetts in 1789, was pronounced by him to be the most disastrous feature in the whole history of educational legislation in Massachusetts. Horace Mann extended his criticisms and suggestions to the examination of teachers and their instruction in teachers' institutes; to the improvement of school buildings; the raising of school funds by taxation; the

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creating of a correct public opinion on school questions; the care for vicious youth in appropriate schools. He discarded the hide-bound text-book method of teaching and substituted the oral discussion of the topic in place of the memorizing of the words of the book. He encouraged school libraries and school apparatus. Horace Mann's influence founded the first normal school in the United States at Lexington (afterward moved to Framingham), and a second one founded at Bridgewater in the fall of the same year (1839). Inspired by the example in Massachusetts, Connecticut was aroused by Henry Barnard, who carried through the legislature the act organizing a state board of commissioners, and became himself the first secretary of it (1839). In 1849, Connecticut established a normal school. In 1843, Mr. Barnard went to Rhode Island and assisted in drawing up the state school law under which he became the first commissioner, and labored there six years.

These were the chief fermenting influences in education that worked a wide change in the management of schools in the middle and western States within the past 50 years. Superintendents of city school systems began in 1837 with Buffalo. Providence followed in 1839; New Orleans in 1841; Cleveland in 1844; Baltimore in 1849; Cincinnati in 1850; Boston in 1851; New York, San Francisco and Jersey City in 1852; Newark and Brooklyn in 1853; Chicago and St. Louis in 1854; and finally Philadelphia in 1883. State superintendents began with New York, 1813; New York was followed by 16 of the States before 1850. From 1851 to the Civil War, eight States established the office of State superintendent; since then, 19 other States, including 10 in the South, that had no State systems of education previously. Normal schools in the United States increased from one, beginning in 1839 in Massachusetts, to 138 public and 46 private normal schools in 1889, with an attendance of upwards of 28,000 students preparing for the work of teaching. This would give a total of some 12,000 a year of new teachers to meet the demand. It may be assumed, therefore, that less than one sixth of the supply of new teachers comes from the training schools specially designed to educate teachers. The history of education since the time of Horace Mann is very largely an account of the successive modifications introduced into elementary schools through the direct or indirect influence of the normal school.

W. T. HARRIS,

*U. S. Commissioner of Education.*

**Education, Indian.** See INDIAN, EDUCATION OF.

**Education, Industrial.** See MANUAL TRAINING; TECHNOLOGY.

**Education, Kindergarten.** See KINDERGARTEN EDUCATION.

**Education, Medical.** See MEDICAL EDUCATION.

**Education, Negro.** See NEGRO, EDUCATION OF.

**Education, Professional, in America.** At the time of the Declaration of Independence there were only two professional schools in the United States, the Medical College of Philadelphia (1765), now the medical department of the University of Pennsylvania, and the medical department of King's College (1768), now Columbia University.

The following statistics for the year 1901, as prepared by the commissioner of education,

show a remarkable growth in this particular phase of education in the United States:

CLASS OF SCHOOLS	Schools	Instr't's	Students	Graduates
Theological . . . .	150	988	7,567	1,585
Law . . . . .	100	1,106	13,642	3,366
Medical . . . . .	154	4,752	26,757	5,472
Dental . . . . .	57	1,184	8,308	2,311
Pharmaceutical . .	58	522	4,429	1,373
Veterinary . . . .	12	189	461	109
Nurse Training..	448	.....	11,599	3,710
Totals.....	979	8,741	72,763	17,926

In 1901, the total amount of property controlled by these schools was estimated at \$130,093,681. Of this total, however, \$96,188,818 is credited to hospitals where there are schools for nurse training. This leaves \$33,904,863 in property invested in the 531 professional schools proper. The income of these institutions amounts to \$3,492,141, and the number of volumes in the school libraries is nearly 3,000,000.

Among the 150 theological schools are 28 Roman Catholic institutions, 29 Presbyterian, 12 Baptist, 22 Lutheran, 10 Congregational, 13 Protestant Episcopal, and 18 of other denominations.

There is no national authority in the United States that can prescribe standards for degrees or for license to practise the professions. Each State makes its own professional laws. As a result there are almost as many standards as there are political divisions. The desirability of uniform standards throughout the country for admission to professional practice is recognized generally, but varying conditions as to density of population, educational advantages, and general development make it impracticable to hope for the attainment of this end for some time to come. In 1850 the public had little protection from incompetency in professional practice. The bar is said to have been at its lowest ebb. Medical laws were crude and largely inoperative. In several States only were there any acts designed to control the practice of pharmacy and dentistry. There was no law whatever restricting the practice of veterinary medicine. There has been extraordinary progress, especially in the last decade, in restrictive professional legislation, and in the admission and graduation requirements of professional schools throughout the United States. In New York State a preliminary general education equivalent to graduation from a four years' high school course after a completed eight years' elementary course is prescribed by statute as the minimum standard for license to practise medicine. This standard approximates that required in continental Europe. New Hampshire has similar requirements, but they are not as rigidly enforced. The statutes of Delaware, Maryland, New Jersey, and Pennsylvania prescribe a "common school education." Louisiana demands "a fair primary education." The rules in Vermont prescribe a high school course; in Illinois and Iowa less than one year of high school work; in Virginia, "evidence of a preliminary education." In remaining political divisions laws and rules are either silent in this respect or so indefinite as to be of little value.

In New York and Illinois a preliminary general education equivalent to a three years' high school course is required for admission to the bar. Connecticut demands a high school

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education or an indefinite preliminary examination. The minimum requirement in Michigan (in case of examination) is less than two years of high school work, in Colorado it is one year of high school work, in Minnesota (in case of examination) it is less than one year, in Ohio it is a common school education. If anything is demanded in other political divisions the requirement is not sufficiently established (excepting a few local cases) to find a place either in statutes or court rules.

The New York law exacts a full high school course as one of the requirements for license to practise dentistry. New Jersey demands by statute "a preliminary education equal to that furnished by the common schools," Pennsylvania "a competent common school education," Virginia a "fair academic education." In other political divisions there is no such requirement. Louisiana, Michigan, South Dakota, Wisconsin, and, in case of examination, California and Texas are the only political divisions which mention in their rules preliminary general education as a requirement for license to practise pharmacy. An elementary education only is prescribed. The completion of a full high school course or its equivalent is one of the statutory requirements for license to practise veterinary medicine in New York. Pennsylvania demands "a competent common school education." There is no such requirement in any other State.

In New York, high standards in preliminary general education are demanded both for degrees and for licenses, and in each case the question of attainments is determined by a central authority, the University of the State of New York. As a rule in other States the professional schools conduct their own entrance examinations, and the tests are often mere matters of form, even though the standards may appear satisfactory on paper.

*Entrance Requirements.*—In 4 theological schools there are no entrance requirements; in 24 schools they are indefinite; 19 demand a grammar school education; 1, 6, and 19 require respectively one, two, and three years of high school work; 18, 3, and 71 demand respectively one, three, and four years of college work.

In 16 law schools there are apparently no entrance requirements whatever; in 8 schools they are so indefinite as to be practically worthless; 26 schools demand a grammar school education; 8, 11, 12, and 3 require respectively one, two, three, and four years of high school work. Harvard demands an education equivalent to that required for admission to the senior class. The Columbia Law School is maintained as a graduate department after 1903.

In 2 medical schools the requirements are indefinite; 29 demand a grammar school education; 97, 12, 3, and 12 require respectively one, two, three, and four years of high school work. Johns Hopkins and Harvard require a college course.

In 3 dental schools the requirements are indefinite; 18 demand a grammar school education; 18, 11, and 6 require respectively one, two, and three years of high school work.

In 6 schools of pharmacy there are no entrance requirements; in 4 schools they are indefinite; 24 demand a grammar school education; 11, 6, and 1 require respectively one, two, and three years of high school work.

In 1 veterinary medical school the require-

ments are indefinite; 9 demand a grammar school education; 1, 5, and 1 require respectively one, two, and three years of high school work.

Courses in theology, law, and medicine are naturally graduate courses and will eventually be maintained as such by leading universities. It is believed, however, that it would not be advisable or even desirable for the State to make graduation from college the minimum requirement in general education for degrees even in these faculties. High school graduation is sufficient for the minimum State requirement.

*University Supervision.*—As long as the public had practically no protection from incompetency in professional practice independent proprietary schools flourished. With proper restrictive legislation such institutions will either die or fall under university supervision.

Many professional schools not under university supervision show a self-sacrificing zeal for high standards and an absence of the commercial spirit that might well be emulated by all institutions connected with colleges or universities. Nevertheless independent institutions are realizing more than ever before the disadvantages of working without university privileges and tend more and more toward university connections or university relations.

*Scholarships.*—Theological seminaries, when not endowed, are supported by funds from the denominations they represent. Tuition is generally free, and in many cases board and lodging are furnished. Additional help is given usually when needed, and generous scholarships are the rule. In other professional schools scholarships are comparatively rare. The latest United States education report gives 40 law school scholarships and 295 medical school scholarships. The largest, offered by College of Physicians and Surgeons, New York, pays \$700 a year and is bestowed to promote the discovery of new facts in medical science.

An examination of 82 law school catalogues shows that 48 scholarships are offered definitely. Tuition is free at the law department of Howard University, the law departments of the universities of Kansas, Texas, and West Virginia. The Harvard law school and the Boston University law school offer a "limited number of free scholarships." Law students may compete for the 150 State scholarships and the 18 university scholarships offered annually at Cornell and for the 50 city scholarships offered by the University of Pennsylvania. The law department of Centre College offers free tuition to sons of ministers and to all young men of limited means and good character. Three schools give fellowships annually as follows: New York Law School, 1 at \$500 a year, good for from one to three years; law department University of Pennsylvania, 1 at \$300, good for one year; Pittsburg Law School, 1 at \$250, good for one year. Thirty-two schools offer cash prizes amounting to \$3,010 and law and reference books as other prizes.

One hundred and fifty-one medical school catalogues report definitely only 152 scholarships and 11 fellowships. These are offered by 31 schools. Five other schools refer indefinitely to scholarships. At Cornell and the University of Pennsylvania medical students may compete for State and university, or city scholarships on an equal footing with those who would enter other departments. Tuition is free at the Army



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Medical School, the medical department of the University of Texas, and the medical preparatory school of the University of Kansas. Nineteen schools give cash prizes amounting to \$5,685; 57 offer hospital appointments as prizes; 47 give gold medals, surgical instruments, and other prizes.

Fifty-six dental school catalogues show that 7 schools offer 58 scholarships. The dental department of the University of Maryland deducts one half from tuition fees of one student from each State on recommendation of his State dental society. The Baltimore College of Dental Surgery had similar beneficiary scholarships till 1898 when they were abolished. Eighteen schools offer prizes but their value is not great.

Fifty-two catalogues of schools of pharmacy show that 5 schools offer 12 scholarships and 2 fellowships. Tuition is free at the schools of pharmacy connected with the Alabama Polytechnic Institute, Washington Agricultural College, Purdue University, and the universities of Kansas, Ohio, Oklahoma, Texas, Washington, and Wisconsin. Fifteen schools offer prizes, usually medals or pharmaceutical instruments. Five of these 15 schools give cash prizes amounting to \$620. The committee on revision of the 'United States Pharmacopoeia' has instituted fellowships in the University of Michigan and the University of Wisconsin for the discovery of new facts in pharmacy.

Sixteen veterinary school catalogues show that 19 scholarships are offered at 5 schools, that 1 school gives a fellowship and that 6 schools offer prizes. Tuition is free at the veterinary departments of Cornell and Ohio universities, and of Washington Agricultural College. Cornell opens to competition by veterinary students, 18 scholarships and to veterinary graduates a fellowship of an annual value of \$500. Veterinary matriculates are eligible for 50 city scholarships offered by the University of Pennsylvania. The veterinary department of Ohio State University offers a scholarship in each county in which the agricultural scholarship is not taken.

**Fees.**—Tuition is free in 132 theological schools. Only 8 have matriculation fees, 33 a course fee, and 34 other fees. The average matriculation fee is \$5.38, the average course fee \$91.61, the average of other fees \$22.06.

Tuition is free in 4 law schools; 23 have matriculation fees (average \$14), 83 have course fees (average \$69.80), 59 have other fees (average \$10.86).

Tuition is free in 3 medical schools; 119 have matriculation fees (average \$10.68), 153 have course fees (average \$82.39), 129 have other fees (average \$49.47).

Tuition is not free in any dental school; 40 have matriculation fees (average \$8.62), 56 have course fees (average \$94.32), 5 have other fees (average \$33.48).

Tuition is free in 9 schools of pharmacy; 28 have matriculation fees (average \$8.07); 43 have course fees (average \$58.90), 50 have other fees (average \$37.90).

Tuition is free in 3 veterinary medical schools; 7 have matriculation fees (average \$7.85), 14 have course fees (average \$81.28), 12 have other fees (average \$43.50).

**Libraries.**—In 1901 the United States commissioner of education reported 1,531,038 vol-

umes in libraries of theological schools, 338,167 in libraries of law schools, 187,207 in libraries of medical schools, 6,860 in libraries of dental schools, 30,216 in schools of pharmacy libraries.

**Endowments.**—The report (1901) of the commissioner of education gives the following figures:

CLASS OF SCHOOLS	Endowment Funds	Benefactions received during the year
Theological .....	\$21,165,174	\$946,473
Law .....	1,151,920	103,000
Medical .....	2,048,182	209,192
Dental .....		
Pharmaceutical .....	23,726	
Veterinary .....		4,500
Nurse Training (Hospitals) ..	18,967,377	2,124,582

**Value of Grounds and Buildings.**—In 1901, the following figures were given, showing the value of grounds and buildings of professional schools:

Theological .....	\$15,217,164
Law .....	1,875,000
Medical .....	14,472,635
Dental .....	1,213,122
Pharmaceutical .....	836,442
Veterinary .....	270,500
Nurse Training (Hospitals) .....	96,188,818

The following report the greatest values in grounds and buildings:

Theology	
General Theological Seminary, Protestant Episcopal .....	\$1,353,000
St. Joseph's Seminary, Roman Catholic .....	1,100,000
Western Theological Seminary, Presbyterian ..	780,055
Law	
University of Cincinnati, law department .....	350,000
Boston University Law School .....	225,000
Medicine	
Columbia University, medical department .....	2,000,000
Jefferson Medical College .....	600,000
Hahnemann Medical College, Philadelphia .....	523,763
Cooper Medical College .....	460,000
Dentistry	
Baltimore Medical College, dental department ..	200,000
Philadelphia Dental College .....	170,000
New York College of Dentistry .....	120,000
Pharmacy	
New York College of Pharmacy .....	204,067
Philadelphia College of Pharmacy .....	150,000

When grounds and buildings are used for several departments, as for example the Columbia Law School which is in the library building, values are not always reported.

**Receipts and Expenditures.**—The latest reports available for 1898 give only a partial report of receipts and expenditures as follows:

TOTAL.				
CLASS OF SCHOOLS.	No. of Schools	Receipts	Schools	Expenditures
Theology .....	76	\$1,561,516	83	\$1,420,921
Law .....	31	565,295	33	540,887
Medicine .....	111	2,185,216	111	2,022,503
Dentistry .....	23	459,996	22	421,680
Pharmacy .....	13	167,098	13	173,994
Veterinary Med. ....	8	86,598	8	89,604
	262	\$5,025,719	270	\$4,669,598

AVERAGE.		
CLASS OF SCHOOLS.	Receipts	Expenditures
Theology .....	\$20,546 26	\$17,119 53
Law .....	18,235 32	16,390 52
Medicine .....	19,686 63	18,220 74
Dentistry .....	19,999 82	19,167 68
Pharmacy .....	12,853 69	13,384 75
Veterinary Medicine .....	10,824 75	11,200 50



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*Women as Professional Students.*—The 1901 United States education report shows that women now appear as students in professional schools of each class except those in veterinary medicine. In nursing they are of course in a large majority, 10,292 as compared with 1,307 men. In the other professions they are reported as follows: Theology, 181, law 170, medicine 1,219, dentistry 166, pharmacy 206. The proportion of women in regular medical schools is much smaller than in homœopathic, eclectic, and physiomedical schools, showing that women prefer the medical sects.

See DENTISTRY; EDUCATION; LAW; MEDICINE; NURSES, *Trained*; PHARMACY; THEOLOGY; VETERINARY; WOMEN, EDUCATION OF.

*Power to Confer Degrees.*—Low standards in many professional schools are due to a failure to subject the degree-conferring power to strict State supervision. In New York and Pennsylvania the laws now prevent an abuse of the power to confer degrees. In Massachusetts and Vermont bodies formed under the general corporation acts are prohibited from conferring degrees. In Ohio and Nebraska the statutes require only the nominal endowment of \$5,000 for a degree-conferring institution. In other States and Territories as a rule any body of men may form an educational corporation with power to confer degrees "without any guaranty whatever that the privilege will not be abused." This matter has been under discussion recently in various educational bodies and there is a strong sentiment in favor of a strict supervision by the State of the degree-conferring power.

*Bibliography.*—It is impossible to give more than a brief outline of professional education in the United States. For detailed information touching laws, regulations, location of schools, and courses of study the reader is referred to 'Professional Education in the United States,' published by the University of the State of New York. Of the many authorities the following are most helpful: United States education reports; Eliot, 'Educational Reform'; United States census reports; Briggs, 'Theological Education, and Its Needs'; Dyer, 'Theological Education in America'; Jessup, 'Legal Education in New York'; Wellman, 'Admission to the Bar'; Hammond, 'American Law Schools, Past and Future'; reports of the American Bar Association; Toner, 'Annals of Medical Progress in the United States'; Davis, 'Medical Education and Medical Institutions in the United States'; Journal American Medical Association; Shepard, 'Inaugural Address at the World's Columbian Dental Congress'; 'Proceedings of the American Pharmaceutical Association.'

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*Education, Roman Catholic, in America.* The educational work conducted under the auspices of the Roman Catholic church in the United States embraces all grades of institutions, from the kindergarten to the university. The official figures for the year 1903 show 4,001 parishes with parochial schools, 646 academies and high schools for girls, 179 colleges for boys, and 7 universities. At least four of these universities, by reason of their collegiate and professional courses, deserve to rank as universities, in the proper acceptance of the term. At the head of the Catholic school system is the Catho-

lic University of America, Washington, D. C., established canonically by Pope Leo XIII., 10 April 1887, and incorporated the same year under the laws of the District of Columbia, with Rt. Rev. John J. Keane, S. T. D., as rector.

About one hundred religious teaching orders of men and women and select bodies of the diocesan clergy conduct this work, with a variety of methods and courses of study, but with a unity of purpose to impart a thorough Christian education to the Catholic youth of the country. In the secular studies, the curricula of schools, academies, colleges, and universities do not differ materially from those that obtain in other American schools. In many instances they are recognized by city or state departments of public instruction, and prepare the students for entrance into the higher public institutions of learning. Throughout all schools and grades the study and practice of the Catholic religion are made important; indeed, it is this solicitude of the church for the influence of Christian faith and morals upon the conscience and character of youth that has called forth and maintains, at immense cost and sacrifice, these thousands of Catholic schools. The Catholic Church considers the Christian religion essentially requisite for shaping the character and regulating the life of her youth, and therefore insists upon its action in her schools, to develop a sense of Christian duty, of obligation, of right and wrong, in conscience and before God. The aim of the church and its attitude toward State schools, wherein the teaching of religion is prohibited, are clearly set forth in the pastoral letter of the American bishops of the Third Plenary Council:

Reason and experience are forcing all Christian denominations to recognize that the only practical way to secure a Christian people, is to give the youth a Christian education. The avowed enemies of Christianity in some European countries are banishing religion from the schools, in order to eliminate it gradually from among the people. In this they are logical, and we may well profit by the lesson. Hence the cry for Christian education is going up from all religious bodies throughout the land. And this is no narrowness nor "sectarianism" on their part; it is an honest and logical endeavor to preserve Christian truth and morality among the people by fostering religion in the young. Nor is it any antagonism to the State; on the contrary, it is an honest endeavor to give to the State better citizens, by making them better Christians. The friends of Christian education do not condemn the State for not imparting religious instruction in the public schools as they are now organized; because they well know it does not lie within the province of the State to teach religion. They simply follow their conscience by sending their children to denominational schools, where religion can have its rightful place and influence.

*Catholic Secondary Schools.*—There is no single, organized system of Catholic secondary schools in the United States. Between the parish school system, now fairly well organized in most dioceses with school superintendents, courses of study, grading of classes, etc., and the university at Washington, there is no uniform plan of intermediate studies. Each secondary school and college is a law unto itself respecting entrance requirements, length and character of courses, and standards for graduation, except in so far as these are regulated by the chartering power under which degrees or honors are conferred. Nor are there any free, endowed Catholic secondary schools besides the Boys' Catholic High School, Philadelphia, founded by the late Mr. Cahill, and the Creighton University, Omaha, Neb., founded by John A. Creigh-

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ton. The secondary schools that do exist are maintained by the teaching orders, mainly through the tuition fees of the students. Living a community life and working without salary, these teachers have been enabled to accomplish much with inadequate resources, and their contribution to the church's educational work in the United States is beyond reckoning. Were it not for their self-sacrifice and devotion to the cause of education, the American Catholic youth would have scarcely any means of prosecuting the higher studies under Catholic auspices. Within the past 10 years efforts have been made with success in several dioceses to secure the foundation of free scholarships for ambitious and deserving graduates of the parish schools.

*Academies and High Schools.*—Under this heading are included the convent schools for girls, manual and industrial training schools for boys, commercial and high schools for both sexes. The elementary course of eight years is supplemented by a course varying from one to four years, in the higher studies of English, languages, science, mathematics, history, commercial studies, art and music, and Christian ethics. Last year there were 646 academies for girls with an attendance of about 25,000.

The manual and industrial training schools are not so numerous, but with the growing demand for artistic work in the trades, each year marks the opening of new trade schools. The Catholic High School, Philadelphia, and the Papal College Josephinum, Columbus, Ohio, are noted for their excellent work. Commercial schools for boys are found in every large city as preparatory schools for those intending a business career. Many parish schools give post-graduate courses in commercial law, bookkeeping and typewriting, and might properly be classed with secondary schools. For some time there has been a tendency to advance the larger parish schools beyond the studies of the grammar grades. One or more advanced classes are devoted to secondary work. At present there are about 50 of these in the larger cities, with an attendance of 450 boys and 750 girls. These figures are not large but they are significant of a growing demand for the advantages of Catholic secondary education.

Less than half of these Catholic academies have reported statistics to the United States Commissioner of Education. Of the 1835 private secondary schools reporting to the Commissioner, religious denominations control 923. Of the latter, the Catholic Church maintains 369, with 1,946 instructors, and 16,786 students, distributed as follows:

	Schools	Instructors	Students
North Atlantic States....	99	556	5,385
South Atlantic States....	35	163	1,227
South Central States....	53	268	2,485
North Central States.....	116	675	5,426
Western States .....	66	284	2,263

*History.*—One of the first high schools for boys in the United States was the classical school founded in 1682 by the Jesuits, in that part of New York city known as "Bowling Green," near the Battery. It was patronized by Gov. Thomas Dongan and by the best Protestant families of the time. Later it had to be closed owing to attacks of bigotry, rampant in that age, but in 1808, Father Antony Kohlmann, administrator of the diocese, bought ground for a new school, in front of the old cathedral. It was opened with

one priest, and four scholastics, and had 35 pupils. A few years after it moved to the site of the present Cathedral, and developed into the diocesan seminary. Among the earliest American academies for girls was the pioneer Ursuline Academy in Canada, founded by Madame de la Peltrie, in 1652. The original building forms the centre of that group which to-day constitutes the Ursuline Convent, Quebec. The first band of Ursulines in the United States reached New Orleans in 1727, and established on August 7, that year, what is probably the first high school for girls in this country. In 1808 Ursulines from Ireland opened an academy in New York city, but failing to receive vocations to the Order, they returned home. In 1820, the historic Ursuline school at Charlestown, Mass., was opened, and at once attracted attention for the excellence of its work. It is said that four fifths of its pupils were from the most distinguished Protestant families of New England. The Visitation Nuns began their educational work in the United States at Georgetown, D. C., in 1799. The saintly Mother Eliza Anne Seton, a convert to the Catholic faith, established in 1809 at Emmetsburg, Md., the Sisters of Charity of Saint Joseph. In 1812, at Nazareth, Ky., a few pious ladies founded the Sisters of Charity of Nazareth, with Mother Catharine Spalding, the first superioress, and in 1818 the Ladies of the Sacred Heart came to the United States, when Madame Duchesne opened a convent at Saint Charles, Mo. Since then other Orders from the old world came here to organize and conduct schools and at least 20 more are original American foundations.

*Catholic Colleges.*—These may be classified as classical, commercial, and a combination of both. They arose to meet the demand for higher education by those destined for the priesthood, the learned professions, and business careers. The tendency to-day is to eliminate the commercial department from the colleges, and thus make them strictly classical and scientific. The Christian Brothers, who had attained distinction in the teaching of the classics, have returned to their primitive rule which forbade this teaching, and are now making a specialty in their colleges of the modern languages, pedagogy and applied science. Excepting Creighton College, Omaha, Neb., there is no free, endowed Catholic college in the United States. Tuition fees have been the main source of revenue; benefactions and endowments have been a rarity; not one Catholic institution appears on last year's list of notable benefactions to American colleges. Lack of funds has hampered many of the colleges in extending the field of their labors and in undertaking many modern methods and improvements. No uniform, definite standard obtains for entrance. In the East an increasing number conform to the requirements of the Regents of the University of New York, or to the regulations of "The Association of Colleges and Preparatory Schools in the Middle States and Maryland." Under the guidance of Rt. Rev. Mgr. Thomas J. Conaty, D. D., rector of the Catholic University, the representatives of 53 Catholic colleges assembled in Chicago in 1899, and organized "The Association of Catholic Colleges of the United States." The purposes of the association are to study the questions connected with college education, to advance the unification of sys-

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terms of Catholic education, and to strive toward a larger development of college work. The Association meets at an annual conference, the report of which is published at the Catholic University. Its organization was perhaps the most important step taken in Catholic higher education since the establishment of the Catholic University.

The colleges are conducted chiefly by the religious teaching orders of men, as follows: Augustinians, 2; Benedictines, 18; Capuchins, 2; Carmelites, 1; Order of Charity, 1; Christian Brothers, 6; Franciscans, 5; Franciscan Brothers, 1; Holy Cross, 5; Holy Ghost, 1; Jesuits, 24; Marists, 5; Society of Mary, 4; Precious Blood, 1; Brothers of the Sacred Heart, 4; Saint Viateur, 1; Vincentians, 2; Zaverian Brothers, 3. Not all of these are reported by the United States Commissioner of Education. In the 60 colleges for which statistics are given, there were (1902-3) 1,375 instructors and an attendance of 14,158 students.

*Colleges for Women.*—The Catholic Church has ever been solicitous to foster the higher education of women, but on lines that will conserve the graces and promote the ideals of true Christian womanhood. The Ursulines and the Ladies of the Sacred Heart conduct several collegiate schools. At Govanstown, Md., the School Sisters of Notre Dame maintain a promising college. Saint Mary's, Notre Dame, Ind., Sisters of the Holy Cross, was founded in 1855 to provide for the highest education as rapidly as means would allow. This is probably the first legally authorized Catholic college for women in the United States, its charter from the Indiana legislature dating back to the year of foundation. The new Collegiate Hall was opened last year. The College of Saint Elizabeth, formerly known as the Academy, Convent Station, N. J., was founded in 1859 and is in charge of the Sisters of Charity. It is chartered under the laws of New Jersey to confer degrees, and is registered by the N. Y. Board of Regents. Its physical and chemical laboratories are splendidly equipped with all modern appliances for advanced work in all the college departments. Saint Mary's-of-the-Woods, Saint Mary's, Ind., was established by the Sisters of Providence, in 1840, and for some years has been empowered to confer academic honors and collegiate degrees. Trinity College, Washington, D. C., in the immediate vicinity of the Catholic University, was organized in 1901 by the Sisters of Notre Dame of Namur, and is strictly a post-graduate college. It is a woman's college of the same grade as Vassar, thus giving Catholic women an opportunity for receiving the highest collegiate instruction.

*Universities.*—Among the Catholic institutions of highest education are the universities of Georgetown, Notre Dame, Creighton, and the Catholic University of America. Saint John's College, Fordham, N. Y., founded in 1841, announces that it will branch out as a university this year, when a medical college will be opened, affiliated in a clinical way with a new hospital in course of erection near by. The oldest Catholic university in the United States is Georgetown, District of Columbia, founded in 1789. It contains a graduate school, collegiate, law, medical and preparatory departments, and an astronomical observatory. The Jesuit Fathers conduct it.

Notre Dame University, Saint Joseph County, Ind., was established 1842 by the Very Rev. Edward Sorin, C. S. C. It has thirteen full collegiate courses, besides excellent courses in art and music. The Creighton University, Omaha, Neb., founded by John A. Creighton and endowed as a free college, was opened in 1879, in charge of the Jesuits. It includes Creighton College, a free, classical day college, and the Creighton Medical College (1892), with a clinic in The Creighton Memorial Saint Joseph's Hospital. The Catholic University of America, Washington, D. C., was established by the American bishops through the munificence of Miss Mary Gwendolin Caldwell. It was solemnly opened 13 Nov. 1889, as the highest seat of learning of the Catholic Church in the United States. By the terms of its Constitutions "the courses of study shall be such in quality and grade as befit a real university." Under the Faculties of theology, philosophy, and law, and the Board of Instruction of Technology are maintained twenty-five departments of university study. The University Colleges, managed by officers under rules laid down by the Board of Trustees, of which His Eminence James Cardinal Gibbons is president, are Divinity College, or Caldwell Hall, and Keane College, named in honor of the University's first Rector, Most Rev. Archbishop John J. Keane, Dubuque, Iowa. Affiliated with the University and grouped about it are Saint Thomas' College (Paulists), Marist College (Society of Mary), Holy Cross College (Fathers of the Holy Cross), College of the Holy Land (Franciscans), Saint Austin's College (Sulpicians), and the Apostolic Mission House (Catholic Missionary Union). Saint Paul's Seminary, Saint Paul, Minn., is also an affiliated college. McMahon Hall, named in honor of the late Mgr. James McMahon, who founded it, contains the chief lecture halls and laboratories. Among the University publications are the 'Catholic University Bulletin,' published quarterly; 'Pittonia,' a series of papers relating to botany; and the 'Year Book,' published annually in April.

*Normal Schools.*—The religious orders of men and women devoted to educational work prepare their novices at their respective mother-houses, which are normal schools, with more or less full courses in pedagogy. Many of these are distinct buildings, equipped with the best appliances used in modern training schools for teachers. The normal institutes of the Christian Brothers at Amawalk and Ammendale, of the Notre Dame Sisters at Waltham, Mass., and San Jose, Cal., and of the Marist Brothers at Dayton, Ohio, are model institutions. In the United States Commissioner's report are the statistics of twelve others, in which the curriculum of normal studies is followed by 215 students. In 1873 Mother Angela, Sisters of the Holy Cross, Notre Dame, Ind., established Saint Catharine's Normal School, at Baltimore, Md. This was the first Catholic Normal school for women in the United States. Its course of study has always been in accord with the best pedagogic methods. Of late years the Jesuits and the Christian Brothers have conducted special pedagogical departments in most of their colleges. In October 1903, the Catholic University opened in New York city an Institute of Pedagogy, where its professors give graduate courses in psychology, logic and ethics, principles,

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methods, and history of education, American history, and library work.

*Catholic Reading Circles.*—The first Catholic reading circle was begun by Warren E. Mosher, in Youngstown, Ohio, in 1889. He also founded and edited the 'Catholic Reading Circle Review,' the monthly organ of the Catholic Educational Union. Under the name of the 'Champlain Educator,' the Review is now the official organ of the Catholic Summer School of America. The same year the Paulist Fathers (N. Y.) established the Columbian Reading Union, with a department in the 'Catholic World Magazine.' Under the Catholic Educational Union, 200 reading circles are organized, with a membership of 6,000; in the Columbian Reading Union are 150 reading circles, with a membership of more than 5,000. The most far-reaching and progressive outgrowth of the movement has been the University extension work through the Catholic Summer and Winter Schools, organized on the well-known Chautauqua plan. The parent Catholic Summer school was established at New London, Conn., in 1892. A year later permanent grounds consisting of 500 acres were secured at Cliff Haven, on the west bank of Lake Champlain. In 1903, 6,000 people were in attendance. The investments of the Catholic Summer School of America represent over \$400,000. The lecture courses embrace literature, art, science, pedagogy, history, philosophy, music, physical culture, and ethics. The New York State Department of Public Instruction has established the Summer School as a summer institute for teachers, and the course in pedagogy qualifies for promotion before the Board of Education, New York city. In 1895 a similar organization was effected in the middle West, at Madison, Wis., where the successful Columbian Catholic Summer School holds its sessions. The Catholics of the South in 1896 opened a Catholic Winter School in New Orleans, where its annual session opens each year after the Mardi Gras celebration. San Francisco also has its Catholic Winter School, and at Emmetsburg, Md., have been held five annual sessions of the Maryland Catholic Summer School.

*Bibliography.*—Shea's 'History of the Catholic Church in United States'; 'Catholic Directory' (1904); 'American Catholic Quarterly Review' (July 1897); 'American Ecclesiastical Review' (June 1896); 'Reports of the Conferences of the Association of Catholic Colleges'; 'Review of Catholic Pedagogy' (1903); 'Report of United States Commissioner of Education' (1902). See PARISH SCHOOLS.

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**Education, Roman Catholic in Canada.**  
See CANADA — CATHOLIC EDUCATION.

**Education, Scientific and Technical.** The development of the schools of science and technology in the United States is, practically, an affair of the last half of the 19th century. In a large measure the same is true of similar institutions in Europe, for although there are isolated examples of earlier foundations it is only during the past 50 years that in number and importance they have come to rank with older systems of intellectual and professional training. Their comparatively recent origin is readily accounted for when it is remembered that they are nearly all schools in which science is taught with a

view to its practical application and that the admission to the college curriculum of any part of what is now generally included under the term "science" was a rare novelty in the early part of the century. The modern scientific school or engineering college is largely indebted for its being to Archimedes, Galileo, Bacon, Kepler, Newton and a host of others who by creating exact science made applied science possible. The idea of a school of science or of a college in which the applications of scientific discovery might be taught was of slow growth at the beginning, and naturally so, for their successful development demanded the evolution of methods of instruction entirely new and often in violation of accepted tradition. A class of professional schools had existed, indeed, almost as long as education itself, namely, schools for training candidates for the so-called "learned" professions, law, medicine and theology, but it will not be claimed that they had much in common, either as to method or material, with the modern school of science.

The earliest technical schools, those of 100 years ago or more, almost without exception, grew out of the industrial demands of the locality in which they were founded. One of the best examples is the famous School of Mines at Freiburg which has enjoyed a long and illustrious career and many of the earlier European schools belong to the same class. To these and the more modern schools of science and technology the United States is greatly indebted, especially on account of the generous welcome that has always been extended to American students and for the inspiration with which many of them have returned to take their part in the wonderful educational evolution which the last half century has witnessed. But in all cases European methods have been adapted rather than adopted. Political, social and material conditions have largely influenced educational foundations, and while the nearly 100 schools of science and engineering scattered over the United States have many points of resemblance, there is much individuality, particularly among the strongest and best, and it is believed that their several types represent important advances in the direction of scientific and technical education which will not be without interest to educators in other parts of the world.

A not very exact classification based on organization easily divides scientific and technical schools into three groups. In the first group are those schools and colleges practically devoted to science and technology exclusively, which have independent foundations and which are not under state or government control. These have almost invariably originated in private endowment, often of one man, and rely for their support upon the income from their endowment and from tuition fees. The second group embraces those schools which are closely affiliated with other colleges or schools forming universities, sometimes without a distinctly separate faculty or special organization, whose work has been largely individualized, sometimes having a distinguishing name, and not under state or government control. Some members of this group are wholly or partly supported by separate endowments and fix and collect their own tuition fees, while others depend upon sharing the common resources of the larger whole of which they are a part. In the third group are included that

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very large and important class of schools supported largely, if not entirely, by state and government appropriation. The organization of some of these resembles in an important particular that of the first group in the fact that they enjoy a separate existence as schools of science or technology, being independent of any college or university affiliation. The majority, however, are not thus independent, and must be regarded as departments of a college, or schools or colleges of a university. A few of them originated in private endowments and do not rely entirely on the state or national government for support, but yet are so largely dependent on that source of revenue that they fairly belong to the group. Something of the origin, history and development of a few of the principal representatives of these three groups will be given, to be followed by some general statements relating to requirements for admission, courses of study, degrees and other matters of interest or importance.

The first endowment and organization of a school of science in the United States was that of the Rensselaer Polytechnic Institute in 1824. Others followed later, for the history of which the reader is referred to the proper title. The requirements for admission are by no means uniform, nor are they extremely varied. Perhaps the typical average requirements for admission to schools of science or engineering colleges would include—besides the “common English branches”—algebra, plane geometry, English literature, history of the United States and either the French or German language. About two to three years’ study of the latter would be required, and to this list will often be added solid geometry, plane trigonometry, the elements of physics or chemistry, and sometimes a year or two of Latin. There seems to be a growing tendency toward the introduction of a large number of electives among the subjects required for admission.

The leading institutions or departments of institutions in which special attention is given to pure and applied science do not differ materially in their organization, courses of study or degrees conferred. Practically all courses are four years in length, in nearly all the first two years are largely preparatory to the special or professional work of the last two, embracing modern languages, mathematics and a few other subjects, most of which are common to all courses offered. The differentiation begins generally at the opening of the junior or third year, although in some cases it must commence earlier. In the matter of degrees the great majority of schools confer only the degree of bachelor of science at the end of the four years’ course, but there are a few that offer the so-called professional degrees such as C. E., M. E., etc., for the mastery of a four years’ course. The requirements for graduate degrees are tolerably uniform, being usually a year of resident study with the preparation of a thesis for the master’s degree, and in addition to this usually three years’ successful professional work with an acceptable thesis for a professional degree. The history of the growth of technical schools shows the enormous educational advance which has taken place during the past 15 or 20 years throughout the whole country, and especially in what is known as the “Middle West.” At no previous period in the history of the world has there been so rapid and

productive an evolution of educational forces as this period has witnessed, and it will not escape notice that it has largely been a development of methods and appliances for the study of science, pure and applied. No sketch of the origin, growth and present condition of the schools of science and engineering in the United States would be complete without reference to the Johns Hopkins University, an institution which, although giving little attention to applied science and technology, has been a very large factor in determining the character and methods of instruction to which these schools owe their success. Although of comparatively recent institution, it is impossible to overestimate its influence upon higher education, and especially is this true in all things relating to science. There is scarcely a college faculty that has not been enriched by the presence of one or more of its graduates, bringing with them at least something of the spirit of that institution, its respect for exact scholarship and regard for scientific truth. For the schools of engineering and technology in the United States are, and are intended to be, something more than a mere avenue leading to increased money-making power. They are intended to fit for the responsibilities of citizenship, and, if worthy of the name, their methods of instruction are such as to cultivate independence of thinking and personal responsibility in judgment. Nor are they deficient in that intellectual discipline and culture which constitute a liberal education. Although not specifically organized for original research, their methods of work naturally lead to and encourage it, and during the past quarter of a century they have contributed generously to the advancement of pure science, to which, however, they must always be in debt. As a whole, they represent one of the most important achievements of an age whose chief glory is found in the increase and diffusion of science and its applications.

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See ARMOUR INSTITUTE OF TECHNOLOGY; CASE SCHOOL OF APPLIED SCIENCE; CHANDLER SCHOOL OF SCIENCE; COLUMBIA UNIVERSITY, *School of Mines*; GREEN SCHOOL OF SCIENCE; LAWRENCE SCIENTIFIC SCHOOL; LEHIGH UNIVERSITY; MASS. INSTITUTE OF TECHNOLOGY; POLYTECHNIC INSTITUTE OF BROOKLYN; ROSE POLYTECHNIC INSTITUTE; SHEFFIELD SCIENTIFIC SCHOOL; STEVENS INSTITUTE OF TECHNOLOGY; VAN RENSSELAER POLYTECHNIC INSTITUTE; WORCESTER POLYTECHNIC INSTITUTE; and each State university, nearly all of which give instruction in applied science.

**Education, Secondary, in America.** The history of American secondary education presents three stages of development: First, the colonial period, with its Latin grammar schools; secondly, the period extending from the Revolutionary War to the middle of the 19th century, with the “academy”; and, thirdly, the period down to the present, chiefly characterized by the growth of public high schools.

The influences which most vitally affected the early development of secondary education in America were the example of the “grammar schools” of England and the rising spirit of democracy, which was largely Calvinistic in its



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modes of thought, and kept in touch with Calvinistic portions of Europe.

Early in the history of the colony of Virginia, funds were raised and lands set apart for the endowment of a Latin grammar school. But these promising beginnings were swept away by the Indian massacre of 1622, and the school seems never to have been opened. The town of Boston, in the Massachusetts Bay Colony, set up a Latin school in 1635, which has had a continuous existence down to the present time. This school was established by vote of the citizens in a town meeting. It was supported by private donations and by the rent of certain islands in the harbor, designated by the town for that purpose; a town rate seems to have been levied when necessary to make up a salary of \$244.50 a year for the master. Other Massachusetts towns followed the example of Boston. School fees were commonly collected. A town rate, which was depended upon at first only to supplement other sources of revenue, gradually came to be the main reliance; and by the middle of the 18th century most of the grammar schools of Massachusetts charged no fee for tuition. Latin schools were early established in Connecticut; one at New Haven in 1641, and one at Hartford not later than 1642. A notable bequest of Edward Hopkins, sometime governor of Connecticut Colony, available soon after the middle of the 17th century, was devoted mostly to the maintenance of Latin grammar schools in Hartford and New Haven, and also in the towns of Hadley and Cambridge in Massachusetts. The Dutch at New Amsterdam opened a Latin school in 1659, continued for some years after the colony passed under English rule. Secondary schools were established in Pennsylvania in the latter part of the 17th century. One of these, the William Penn Charter School at Philadelphia, has continued down to the present day. King William's school at Annapolis was erected by the legislature of Maryland in 1696, and similar schools were established in different sections of the same colony. The 18th century saw schools of like character opened, partly by legislative enactment, partly by private initiative, in these and in the remaining colonies. Some of the number, like the University Grammar School in Rhode Island and the Free School at New York, were forerunners of the accompaniments of colonial colleges. In the organization of colonial systems of secondary education important beginnings were made. In 1647 the colonial legislature of Massachusetts decreed that an elementary school should be maintained in every town of 50 families; and that in every town of 100 families there should be a grammar school, in which students might be fitted for the university. This provision was copied by the colonies of Connecticut and New Hampshire, and in Connecticut the provision was afterward changed to require a grammar school in each county town. These New England colonies maintained and enforced such provisions down to and after the Revolution. Maryland also established by law a system of county grammar schools. When the colonies were transformed into States, after the Declaration of Independence, the systems of schools in the four colonies mentioned were continued with little change, but no other of the 13 States had anything that could be called a system of public instruction.

The chief emphasis in these colonial schools was laid on preparation for the college entrance examination, and the requirements for admission to college determined their course of study. The colonial grammar schools accordingly taught Latin, a little Greek, religion, and little else.

Both grammar schools and colleges were intended especially for the directive and professional classes, and had little connection with such elementary schools as there were. In Massachusetts, towns which maintained grammar schools were not required to maintain reading schools. Sometimes pupils were taught to read in grammar schools. But the grammar school teachers objected to this burden; and the mixing of the two grades of instruction in one school was recognized as an evil. The grammar schools exercised a kind of selective function, discovering latent capacity for the higher studies and starting talented youth on the way to college. Those who showed capacity of a lower grade or of a different sort received little attention or encouragement.

As we approach the Revolutionary period, we find new social conditions giving rise to a new order of schools. With the growth of sectarian differences, there appeared a decided tendency toward the separation of governmental from ecclesiastical affairs, and thus the position of educational institutions was disturbed. This change lessened the prestige of colonial systems of education among the adherents of the religious denominations, and a growing distrust of the colleges appeared among those who were most in accord with the secularizing tendency of the time. The old grammar schools were weakened by these influences, and in their stead there grew up a new type of secondary school, commonly known as the academy.

Both the name and the character of the new institution were suggested by precedents in England, where Dissenters were excluded from grammar schools and universities. In the latter part of the 17th century the non-conformist bodies first established "academies," schools in the main of secondary grade, which, however, undertook to prepare candidates for the non-conformist ministry.

The fame of the English academies seems to have influenced the thought of the American colonists in the matter of public education; first the strong theological bent of their English prototypes reappeared in the new American schools; and then the resemblance was more obvious in the wide range of studies offered, for the English academy had been more practical and technical than the university. But the American academies soon came to have a well-defined character of their own, apart from any conscious imitation of English models.

In 1726, a school for classical and theological studies was established by a Presbyterian minister at Neshaminy, in Pennsylvania. It was commonly known as the "Log College," as its home was a building made of logs. This school in the wilderness was the centre of deep and widespread interest in classical studies as well as in the religious life. It sent out large numbers of zealous pastors and teachers, who established "log colleges" all over the highlands of the middle and southern colonies. The Neshaminy Log College itself was later incorporated with what is now Princeton University.



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Through the efforts of Benjamin Franklin, a school was established at Philadelphia, legally incorporated as an academy in 1753, and probably the first institution in America formally designated by that title. It was under the control of a self-perpetuating board of trustees. A fund raised by private subscription for its establishment and maintenance, was supplemented by a grant from the city treasury and by tuition fees, which were remitted in the case of those unable to pay. This academy organized in three departments or schools; namely, the Latin, the English, and the mathematical, put little stress on the theological element and much on English language and literature, and the mathematical sciences. The school ultimately developed into the University of Pennsylvania. Within two or three decades after the founding of this school at Philadelphia, a number of schools somewhat similar in character, and some of them bearing the name academy, were established in the middle and southern colonies. In New England the two Phillips academies, one at Andover in Massachusetts and the other at Exeter in New Hampshire were incorporated in 1780 and in 1781, respectively. The influence of these two schools extended to remote States, especially in the growing West; and they still rank among the strongest and most influential secondary schools.

Soon after the close of the Revolutionary War, new State systems of education began to be established, in which special provision was made for secondary schools. The University of the State of New York, erected in 1784, is a notable example of the strong influence which French thought then exercised in American affairs, as it realized the conception of a university put forth by Diderot and others of the great French writers of the latter half of the 18th century. It embraced the whole provision for secondary and higher education within the State, with the exception of schools of a purely private character. Its control was vested in a board of regents, consisting of the governor and the lieutenant-governor, *ex officio*, and 19 members elected by the State legislature. The reorganization of 1787 accordingly made the board of regents distinct from the board of trustees of Columbia College, with which it had been identical. This "university" exercised great influence on later systems; and in Georgia, by an Act, passed in 1785: "All public schools instituted, or to be supported by funds or public moneys in this State, shall be considered as parts or members of the university"; and in the territory of Michigan, an act was passed in 1817 instituting a university of imposing character. The latter establishment existed mainly on paper, and the act incorporating it was repealed in 1821. The Georgia "university" also never amounted to much. But although the comprehensive type of university organization was not widely adopted, there was a general desire in the early part of the 19th century to establish complete and well-rounded systems of public instruction. The legislature of Tennessee declared in 1817 that, "Institutions of learning, both academies and colleges, should ever be under the fostering care of this legislature, and in their connection with each other form a complete system of education." Even more significant is the provision of the constitution of Indiana, adopted in 1816, that, "It shall be

the duty of the general assembly, as soon as circumstances will permit, to provide by law for a general system of education, ascending in regular gradation from township schools to a State university wherein tuition shall be gratis and equally open to all." For the most part, however, actual State agency in secondary education was as yet limited to the subsidizing of privately managed academies. In Massachusetts, the provision for grammar schools under town control was continued after the colony became a State, but the law was so changed that only the larger towns were left subject to this requirement. At the same time academies established by private initiative were endowed by the legislature with grants of public lands. In Kentucky, the State legislature granted 6,000 acres of public lands to an academy in each county. In Pennsylvania, colleges and academies received financial aid from the State for many years, culminating in 1838 in a general State system of educational subsidies. Five years later, such aid was discontinued. In other States, the granting of State subsidies, in money or in lands, to secondary and higher schools, was customary for many years. For the most part, there is but little system or consistency observable in the distribution of such aid; and the State-aided institutions were not subjected to any sort of State control.

The type of secondary school which grew up under these conditions demands closer consideration. The old academies were generally endowed institutions, organized under the control of self-perpetuating boards of trustees or of religious bodies, established to serve the need of a wide constituency and not merely of a single community, and often located in small country places. Many of them made provision for boarders as well as for day pupils. They were not intended in any exclusive sense for the training of future members of the learned professions, although many of them developed into preparatory schools. In the western States preparatory schools attached to colleges were commonly called "academies." But such was not the earlier purpose of the academies, which were largely schools for the middle classes, and answered to a growing desire after learning for its own sake, or for the increased efficiency it would give in other than professional pursuits.

Their training was more "practical" than that of the colleges, wider and more liberal than that of the grammar schools, or of some of the colleges. They laid new stress on the study of the English language, together with grammar, rhetoric, and public speaking. They taught mathematics, often including surveying and navigation; began the study of natural science, especially of natural philosophy (physics), of which astronomy constituted an important division; gave courses in geography, ancient history, English and above all American history, French often and German seldom. Latin and Greek were the substantial core of the instruction offered. In the earlier days, the course of study was not well defined. In English, Latin, and mathematics, a good degree of continuity of work was apparently maintained, but in others, classes were formed at irregular periods, because of the exigencies of rural life which demanded that certain courses be confined to a short winter term not interfering with farm labor. When finally definite courses of study

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were laid out, they varied in length from three to four or five years. Parallel courses were offered. That including classical studies and covering the required preparation for admission to some college was commonly regarded as the standard course of the school. With this might be found an English course. Afterward a scientific course was often provided.

Many of these schools were established by religious bodies. Catholic secondary schools began to appear in this period, established by the several teaching orders. The Society of Jesus founded institutions of secondary and higher education in the United States after the Revolutionary War; the Brothers of the Christian Schools opened their first school in America at Montreal in 1838; soon after set up establishments within the United States, at Baltimore and New York, and followed these elementary schools with secondary courses; and besides many conventual schools for girls were established, which drew a large clientele from other than Catholic families. The academies established by Protestant bodies usually terminated their formal connection with ecclesiastical societies upon their legal incorporation. The religious instruction which they carried on concerned itself for the most part with the broad underlying principles of Christianity, so that the non-Catholic academies, even such as had arisen from the initiative of religious societies, tended toward the non-sectarian character which has been more fully exemplified in the public schools of later times.

The grammar schools had been exclusively for boys. Such was the case with many of the academies. But others were coeducational, and there grew up also a large number of academies for girls, which were all too often weighed down with the title of "female seminary." The last two prepared the way for two types in higher education, appearing in the fourth decade of the 19th century, namely, the coeducational college and the college for women exclusively.

The academies broadened the intellectual horizon of families and communities, and reinforced the protest which was arising against the narrow curriculum of the American colleges. In the absence of special schools for the training of teachers, the better elementary schools were for a long time in the hands of academy graduates. Special classes were organized in New York and Pennsylvania academies for instruction in the art of teaching, and a seminary for teachers was opened in connection with the Phillips Academy at Andover. When State normal schools began to be established, in Massachusetts in the year 1839, suggestions for their organization and management were drawn from this seminary and from the current practice of the academies.

In the early part of the 19th century, there appeared a strong demand for schools under the exclusive control of the State. The Calvinistic view of the civil power had apparently prepared the way for State agency in education, and the steadily advancing separation between Church and State kept alive the question as to the relation of the schools to both. The well-established theory that the State should grant charters to colleges, authorizing them to manage their own affairs under close corporations, with incidental aid from the State in the shape of gifts of land or money, was long applied to

secondary education as well. The first step in the establishment of public secondary schools was taken by the larger towns and municipalities, under the lead of Boston, where in 1821 was established an "English classical school," which soon took the name of "English high school," imitating the style of the Edinburgh High School, from which the new Boston school differed in not including the ancient languages in its curriculum, and in not employing the monitorial method of instruction. Its course was three years, embracing English language and literature, mathematics, navigation and surveying, geography, natural philosophy (including astronomy), history, logic, moral and political philosophy. Latin and modern languages were added afterward and the course extended to four years. Students were received into the high school from the elementary schools of the city, but at first were not prepared for admission to college, that being the function of the Latin school. But with the addition of foreign languages to its course of study, the English high school fitted its students for admission to certain higher institutions.

Other Massachusetts towns followed the lead of Boston in this matter. Philadelphia, in 1838, established the Central High School, under special authorization from the Pennsylvania legislature. Baltimore followed, with the establishment of a "city college." Providence opened a public high school in 1843. Hartford, in 1847, transformed her old grammar school into a school of the newer type. New York opened a "free academy" in 1848, the name of which was afterward changed to the College of the City of New York. This school was established in accordance with a special act of the State legislature, ratified by vote of the people of the city. Later growth was rapid and widespread, although the movement encountered hostility from those who regarded the academy as the final or best solution of the problem of public secondary education, and from those who were opposed on principle to the recognition of secondary education as a proper field for governmental agency. The legal questions involved in this latter contention were settled by the supreme court of Michigan, in what is commonly known as the "Kalamazoo case," the decision being: "Neither in our State policy, in our constitution, nor in our laws do we find the primary school districts restricted in the branches of knowledge which their officers may cause to be taught, or the grade of instruction that may be given, if their voters consent, in regular form, to bear the expense and raise the taxes for the purpose."

As early as 1798, Connecticut authorized the opening of higher schools by the local authorities ("school societies"). In Massachusetts, the law requiring grammar schools in the towns was so far weakened, in 1824, that towns having a population of less than 5,000 were allowed to substitute therefor an elementary school. But two years later it was enacted that every town having 500 families should provide a master to give instruction in history of the United States, bookkeeping, geometry, surveying, and algebra; and every town having 4,000 inhabitants, a master capable of giving instruction in Latin and Greek, history, rhetoric, and logic. Iowa adopted a provision in 1849 expressly permitting the adding of higher grades to the public

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schools; and in 1858 authorized the establishment of county high schools. In New York, systematic grading of the schools went steadily forward; and the "academic departments" of these schools, corresponding to the high schools of other States, formed a part of the University of the State of New York and received financial aid from the literature fund. In Maryland, the county academies, which had displaced the grammar schools of colonial days, continued for many years to receive financial aid from the State, and only in comparatively recent times were merged into a State system of high schools.

We have seen that by the middle of the 19th century the academies were now *par excellence* the preparatory schools of the country, and that the growth of high schools had taken away from them the character of the ordinary provision for secondary education. Many of them declined as the high schools advanced; many were given over to the communities in which they were conducted and became high schools, under public management; and those that survived laid more and more stress on their function of preparing for college. While the high schools are for day pupils only, the academies are generally boarding schools. At the first there was an organic connection between the high schools and schools of elementary grade, but a recognized gap between the high schools and institutions of higher learning, the earliest high schools being intended specifically for those who were not preparing for college. But there soon appeared a disposition on the part of the public school authorities to close up this gap, and studies regarded as distinctively preparatory to college were introduced into high school courses.

Even when the high schools had begun to prepare their more favored students for college, the connection between the secondary and the higher institutions was not so close as was desired, because of the inherent differences between the college and the secondary system, especially in the East where few universities were under State control. For a long time the most powerful single agency affecting the course and the methods of instruction in the better high schools, as in the academies, was the entrance examinations of the several colleges.

Thus the college examination became the chief end and aim of much of the work in secondary schools, and there appeared a marked tendency to substitute a cramming process for real educational procedure. The attempt to correct this evil has taken several different directions. One of the earliest and most noteworthy attempts at its solution is the so-called accrediting system, introduced by the University of Michigan in 1871. Under this system, the university admits to its freshman class, without examination, such graduates of approved secondary schools as are especially recommended for that purpose by the principals of those schools. It depends upon a purely voluntary agreement between the secondary schools and the higher institutions, so that the school rather than the individual is examined; and the inquiry relates chiefly to the vitality, intelligence, and general effectiveness of the instruction. The highest grade of efficiency in university inspection is found in such a system as that maintained by the University of California,

where the accrediting of schools is in the charge of a committee of the academic senate, some of whose members visit every year all secondary schools within the State which apply for accrediting.

The purpose of a well-considered accrediting system is not to provide a means whereby applicants for admission to college may escape a dreaded examination, but to encourage and build up strong and efficient schools of secondary grade.

The disadvantages of the system are that it tends to foster a disposition to evade all tests of accurate scholarship in the shape of definite examinations; that it entails a heavy burden upon the higher institution; and demands large expenditures of money and of the time of university instructors. In the University of California, the actual cost in money for the traveling expenses of the inspectors is about equal to the salary of an assistant professor and the aggregate of the time required each year by all departments for the purposes of examination of schools is not far from three full academic years. The accrediting system cannot be regarded as a final solution of the problem with which it deals, but it marks a great advance, and it is safe to say that its present advantages greatly outweigh its obvious disadvantages.

Parallel with the later development of the accrediting system, there have grown up important voluntary associations of instructors, in which representatives of the colleges meet with representatives of the secondary schools for the discussion of topics of common interest. The parent society of this sort is the New England Association of Colleges and Preparatory Schools, organized at Boston in 1885. This organization prompted the establishment of the commission of colleges in New England on admission examinations, which, by its recommendations, has done much to unify requirements for college matriculation.

The Association of Colleges and Preparatory Schools in the Middle States and Maryland came into existence in 1892. The North Central Association of Colleges and Secondary Schools was formed at Evanston, Ill., in 1895; and the Association of Colleges and Preparatory Schools of the Southern States, at Atlanta, Ga., in the same year. State organization somewhat similar in character are found in a number of the States, as in New York, Ohio, Tennessee, Colorado, Michigan, and both Dakotas. These various societies, through their discussions and recommendations, have exercised a vast influence upon the development of our secondary education.

But the chief landmark in the recent history of this grade of school is the work of the Committee on Secondary School Studies, appointed by the National Educational Association in 1892, and commonly known as the "Committee of Ten." This committee was the outcome of a movement within the national association in the direction of uniformity of college entrance requirements. Not limiting itself to the mechanical adjustment of relations between the high school and the college, this committee proceeded to consider the problem of secondary education from an educational point of view. Nine sub-committees of 10 members each were appointed to prepare reports on the several or-

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dinary departments of secondary school instruction, namely, Latin, Greek, English, other modern languages, mathematics, physics (with astronomy and chemistry), natural history (biology, including botany, zoology, and physiology), history (with civil government and political economy), and geography (physical geography, geology, and meteorology). The Committee of Ten, having secured carefully prepared reports from its sub-committees, and having examined a large number of the courses in actual use in secondary schools, drew up a report which was published by the United States government in December 1893, together with the reports of the several sub-committees. Great stress was laid on the correlation of studies in secondary schools, the unifying of many subjects into a well-knit course of instruction, through the recognition of their numerous inter-relations. The committee would have continuous instruction in the four main lines of language, mathematics, history, and natural science. In particular, they recommended that in the first two years of a four-year course, each student should enter all of the principal fields of knowledge, in order that he may fairly "exhibit his quality and discover his tastes"; and urge the postponement of the beginning of Greek to the third year, in order that the student may not find himself at the bifurcation of the course into classical and Latin-scientific courses, before he is ready, or his advisers sufficiently informed as to his capabilities, to make an intelligent choice. The committee would require in each course a maximum of 20 recitation periods a week; but they would have five of these periods devoted to unprepared work; and would reserve double periods for laboratory exercises whenever possible. With reference to requirements for admission to college, the committee recommend "that the colleges and scientific schools of the country should accept for admission to appropriate courses of their instruction the attainments of any youth who has passed creditably through a good secondary school course, no matter to what group of subjects he may have mainly devoted himself in the secondary school." "A good secondary school course" they describe as consisting of any group of studies from those considered by the sub-committees, "provided that the sum of the studies in each of the four years amounts to 16, or 18, or 20 periods a week,—as may be thought best,—and provided, further, that in each year at least four of the subjects presented shall have been pursued at least three periods a week, and that at least three of the subjects shall have been pursued three years or more."

Since the early days of the academies, it has been customary in many schools to offer alternative courses; one of them classical, the other "modern." Especially within the last 25 years, there has appeared a strong demand that instead of a choice of courses the students be offered a wide range of choice in particular subjects. Several influences have combined to bring about this demand. Teachers have objected to close prescription in high schools when freedom is increasing in the higher institutions. The conviction that the secondary schools should not be merely tributary to the colleges is gaining ground, and the independence of the secondary school carries with it independent responsibility for the supply of the actual educational needs

of the youth attending such a school. It is urged that, since no two students have exactly the same aptitudes, so far as possible, every student should pursue a different course of instruction from every other student. This doctrine substitutes a quantitative for a qualitative consideration of the curriculum. A high school curriculum, under this system, would consist of a fixed number of units of study, to be chosen at will from the whole number of studies taught in the school. Certain utterances of the Committee of Ten have tended to strengthen this quantitative view of the curriculum. In the attempt to reduce this doctrine to practice, certain modifications necessarily enter. The choice of studies cannot be left simply to the immature pupil. Even if other subjects may be given over to absolute freedom of election, studies in English are found to be indispensable in every course. Little by little, other subjects are acknowledged to be essential; until it appears that there is little difference in practical working between a system of parallel courses rendered flexible by the allowing of occasional substitutions, and an adequately supervised elective system.

The latest attempt at an adjustment of the relations of secondary schools and colleges, to the educational advantage of both, is contained in the report of the Committee on College Entrance Requirements, appointed in 1895 by the National Educational Association, and consisting of 14 members, representing the high schools and universities of different sections of the country, under the chairmanship of the superintendent of high schools of the city of Chicago. The first important service rendered by the committee was the preparation and publication of a table showing the actual entrance requirements of 67 representative colleges, universities, and higher technical schools in the United States. The committee's final report, presented at the meeting of the National Educational Association in July 1899, is mainly devoted to the attempt to establish "national units, or norms," in the several subjects taught in the secondary schools as preparatory to the college course. The fundamental problem "is to formulate courses of study in each of the several subjects of the curriculum which shall be substantially equal in value, the measure of value being both quantity and quality of work done." In the determination of these norms, the committee received assistance from several bodies of expert scholars in the several branches of instruction. The American Philological Association proposed courses of study in Latin and Greek; The Modern Language Association of America rendered a like service with reference to the French and German languages; the American Historical Association and the Chicago section of the American Mathematical Society reported on courses in history and mathematics; and the Department of Natural Science Instruction of the National Educational Association presented recommendations relating to physical geography, chemistry, botany, zoology, and physics. These several supplemental papers are published in connection with the committee's report. The committee adopted 14 resolutions, of which the following are of the greatest general significance:

1. That the principle of election be recognized in secondary schools.

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4. That we favor a unified six-year high school course of study beginning with the seventh grade.

6. That while the committee recognizes as suitable for recommendation by the colleges for admission the several studies enumerated in this report, and while it also recognizes the principal of large liberty to the students in secondary schools, it does not believe in unlimited election, but especially emphasizes the importance of a certain number of constants in all secondary schools and in all requirements for admission to college.

12. That we recommend that any piece of work comprehended within the studies included in this report that has covered at least one year of four periods a week in a well-equipped secondary school, under competent instruction, should be considered worthy to count toward admission to college.

Actual courses of study in our secondary schools show great diversity, as this matter is generally left to the discretion of municipal or district boards of education. Owing to the extensive circulation of all sorts of educational publications, however, and the frequent meeting of teachers one with another in educational conventions, there is a surprising approach toward uniformity in the educational provisions found in all parts of the country. High schools may be found having courses ranging all the way from one to six years in length; but the four-year course is the generally recognized standard. Twenty years ago, it was common to find courses weighed down with a large number of subjects, many of them pursued for only a fraction of a year. This was notably true of subjects in natural science; but it is true to a much less extent at the present day. In spite of all assaults made upon the classical studies, it would perhaps be fair to say that in many of the better schools, public as well as private, the classical course is commonly regarded as the standard, from which the other courses pursued in the same school are looked upon as variants.

The differentiation which appears everywhere in our secondary education appears in the erection of special schools for special classes of students. There is separate schooling of boys and girls, in many instances. The report of the United States commissioner of education for 1896-7 showed a total of 5,109 public high schools in the whole country, of which 35 were for boys only, 26 for girls only, and the remainder coeducational. The same report showed a total of 2,100 private high schools, academies, etc., of which 351 were for boys only, 537 for girls only, and 1,212 coeducational. Another special type of school, the evening high school, has been established in a number of our larger cities. These schools have offered very elastic courses of study, suited to the varied needs of their clientele; and have been a great boon to many who have been obliged to work by day after the completion of an elementary school course. In the Southern States there is further separation between white and colored children, although the latter class of course do not bulk largely in secondary education.

As to manual training schools, St. Louis in 1879 established such a school in connection with Washington University, and within a few years similar schools were established in Baltimore, Chicago, Toledo, New York, Philadelphia,

and other cities. In these schools, the idea of manual training for the purposes of general culture was usually uppermost, their projectors disclaiming any intention of establishing schools for the teaching of trades. More recently trade schools have been established in the largest cities, but for the most part under private initiative and control. The commercial spirit of this country finds expression in the frequent appearance of such subjects as bookkeeping and commercial arithmetic in general courses of study. Special schools for distinctively commercial training are usually private ventures. These are found in great numbers in all parts of the country, generally going by the name of "commercial college" or "business college." The business high school in Washington, D. C., may be mentioned as one illustration of the serious interest which has begun to appear in this side of secondary instruction. See EDUCATION, COMMERCIAL.

One movement should be mentioned which is part cause and part result of the increased attention which is now paid to problems of secondary education, in themselves considered. Reference is made to the study of the several aspects of adolescence, as a stage in the mental development of individuals. Secondary education being essentially the education of adolescents, whatever throws light upon the peculiar psychology and natural history of this period of youth is of value to the educator. Many studies of particular phases of adolescent development have been made within the past few years, under the stimulus of investigations begun at Clark University. These studies are as yet fragmentary; and they cannot be said to have led to well-defined reforms. Yet their influence has been manifest in the general tone and spirit of secondary education. They have prompted to a more sympathetic treatment of our youth in their time of spiritual reconstruction; to a better appreciation of the difficulties attending the passage from the intellectual dependence of childhood to the individual convictions of manhood and womanhood. They have led to a more careful observation of individual differences of development, and have strengthened the demand for greater freedom in both courses and methods of instruction.

Methods of instruction in all secondary school subjects have been profoundly influenced of late from the side of the natural sciences. Laboratories have become common in high schools and academies. College entrance requirements have been extended to include laboratory work in physics, and, in some instances, in chemistry or in the biological sciences. In these laboratories, students perform representative experiments in the science they are pursuing, under the guidance and subject to the criticism of the instructor. These experiments are commonly regarded as illustrative of or preparatory to the statement of principles in a text-book. The "method of re-discovery" has influenced the practice of the schools; yet there are probably few school laboratories in which the students are expected to re-discover on their own account the laws of physics or chemistry, or of any other of the sciences. A fine blending of discovery, verification, and correction seems to be the ideal of our best teachers of natural science. Much stress is laid on the accurate recording of observations and experiments. The students' note-books serve as one of the chief tests of the excellence of their



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work. This is a great advance upon the prevailing method of a generation ago, when the textbook was the main reliance in school instruction, even for classes in the natural sciences. A like change appears in the treatment of other branches than the natural sciences. The attempt is now made to put the student in touch with first-hand materials of knowledge; and to guide and stimulate him to the end of making over these crude facts into real knowledge for himself. This procedure seeks to give full recognition to both the ideal and the sensuous elements in knowledge, and indicates some appreciation of the fact that the ideal element to be truly ideal must be supplied by the active agency of the student's own thought, exercised upon the products of his own experience. In the practice of the schools, we find these principles applied, for example, to the teaching of history. Although text-books are not dispensed with, the effort is made to give the student some acquaintance with the sources of historical knowledge. In the study of literature, less attention is paid to historical summaries than was formerly the case, and more time is devoted to the study of literary masterpieces. In grammar and rhetoric, the study of principles is closely connected with the study of passages from literature which embody those principles in living forms; and with composition exercises upon topics which invite free expression. In modern languages, facility in conversation is not commonly sought, but the ability to read the languages readily and with understanding, and to enter into an appreciation of their literatures, is the end chiefly striven for, and grammar is studied, on the whole, less abstractly than formerly, and more in its actual embodiment in literature. Greater effort is made now than a generation ago to secure a reading knowledge of the ancient classics. There is much difference of opinion among leading teachers as to the proportionate attention to be paid to "sight reading"; and as to the value of the inductive method in the mastery of grammatical principles; but actual practice seems to be tending slowly toward a middle course, which retains much of the old-time thorough discipline in Latin and Greek grammar, but brings this training into more vital connection with the study of classic literature. The question of approaching Attic through modern Greek has been warmly discussed, but the proposed change finds little, if any, acceptance in actual practice. In mathematics, much stress is laid upon the original demonstration of theorems, particularly in plane and solid geometry. Much stress is put upon the use of accurate language in mathematical demonstrations, and, more generally, on the need of more careful and accurate English expression in all school exercises. The attempt to teach English expression, oral and written, wholly through the medium of instruction in other branches does not promise well; but there is a growing recognition of the fact that all teachers must have at least some share in the responsibility for such instruction.

The moral influence of secondary schools is undoubtedly the most important topic to be considered in this paper, but it is at the same time the most difficult to reduce to accurate statement. The religious background of moral instruction has already been referred to. It should be added that even in public high schools, from which all instruction in sectarian dogmas is

strictly excluded, there is not uncommonly found a pervasive religious atmosphere, an influence emanating from the personal character of the instructors. In many of these schools, it is still customary to open the daily session with the reading of a passage from the Bible or the repetition of the Lord's prayer; or with the singing of a devotional or patriotic hymn. In some schools, elementary ethics is taught, but this is unusual, and moral force depends mainly on the personal influence of the teachers, on the government of the school, and on the relations of the students one with another.

Some subjects of instruction offer especial advantages as regards the formation of high ideals of conduct. The teaching of literature, and particularly the literature of the mother tongue, is found to be of great value in this respect—the more so, doubtless, when untimely moralizing is dispensed with, and noble sentiments are permitted to make their appeal through the charm of their artistic presentation. Choice works of plastic and pictorial art are rapidly finding their way into our school rooms, and are expected to accomplish their mission by their mere presence; or to reinforce the aesthetic side of instruction in literature and in drawing. History is probably, on the whole, the most neglected of the main lines of study in secondary schools; and the moral loss resulting from such neglect is serious. Greek and Roman history is commonly taught, at least in classical courses; but too often in a scrappy and inadequate fashion. Later European history receives some attention. The history of the United States is, perhaps, the most seriously slighted of all. The reason for this seems to be that the history of our own country is studied in the grammar schools; and it is only beginning to be emphasized by the colleges as an admission subject.

In the government of our best secondary schools, the relations of teachers and students are comparatively informal, and there is little consciousness of official or artificial barriers between them.

Some interesting and successful experiments have been made in the organization of regular systems of self-government among students. Under any system of government, the social life of the school is the chief teacher of morals. The fact that tuition in these schools is free to all, helps to bring about this result. It is unnecessary to point out the numberless bearings of this democratic spirit in the schools upon the pupils who are subject to its influence. There is undoubtedly a growing disposition among families of wealth and high social position, to send their children to private schools. This disposition is, however, by no means universal.

The social organization of the students in high schools and academies is much alike. The instinct of association is strong and finds expression in clubs, leagues, societies, and fraternities. The several classes are commonly organized, with class officers, and have occasional gatherings of a social character. The offices of the highest class in school are sought for with keen competition. Athletic associations, football and base-ball clubs, and the like, are usually maintained, and several schools often join in an athletic league. Debating clubs and other literary societies are maintained with much interest. Contests in debate with neighboring schools call



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forth a spirit of emulation like that displayed in athletic struggles. Musical organizations are among the most pleasing of school societies. Annual publications by successive classes present a record of the varied interests of the larger schools. Besides Greek-letter societies, formed after the fashion of the colleges, there are sometimes voluntary associations for religious culture and observance maintained by the students. All of these organizations are commonly under the immediate control of the students themselves. The completion of the course of study in a secondary school is celebrated in public with "graduation" exercises and the conferring of diplomas upon the members of the class. The graduates of a flourishing school usually organize in an alumni association.

A committee of the National Educational Association—the so-called Committee of Fifteen on elementary education—reported in 1895, among other topics, on the training of teachers for secondary schools. This committee declared that, "The degree of scholarship required for secondary teachers is by common consent fixed at a collegiate education." They proposed a course of special training for such teachers, consisting of instruction during the senior year of the college course in psychology, methodology, school systems, and the history, philosophy, and art of education; and a graduate year of practice in teaching, under close supervision, supplemented by advanced studies in educational theory. This proposal is far in advance of common practice or requirement. Very few of the American States make any specific requirement for the high school teacher's certificate beyond that for a license to teach in the elementary schools. But in many secondary schools teachers rarely obtain employment unless they are college graduates; and there are large sections of the country in which common usage is rapidly tending in this direction. The most of the leading universities and some of the higher normal schools are devoting especial attention to the professional training of teachers for schools of this grade. A Massachusetts report for the year 1897 shows that one per cent of the high school teachers then employed in that State were graduates of scientific schools, 13 per cent of normal schools, and 66 per cent of colleges. In the State of New York, in 1898, 32 per cent of the teachers in secondary schools (not including principals) were college graduates, 39 per cent were normal school graduates, and 19 per cent were high school graduates. Of the principals, 51 per cent were college graduates, 35 per cent normal school graduates, and 8 per cent high school graduates. These figures include private academies as well as public high schools. They include also one-year, two-year, and three-year schools, as well as fully developed high schools and academies. An inquiry into the preparation of teachers in the secondary schools of California, in October 1897, showed that of the teachers then employed in the public high schools of the State 59 per cent were college graduates.

The several States have been slow to organize general systems of secondary schools. But a few have made considerable progress. The early history of secondary schools in Massachusetts has already been told. This State is the foremost in the Union in the universality of its provision for secondary education. Every

"town" (township) in the State is required by law to provide free high school tuition for all students who are prepared for that grade of instruction. Inasmuch as the whole State is divided into towns, this means that free secondary education is offered to every child in the commonwealth. Of the 353 towns in the State, 185 are required by law to maintain high schools; 70 others maintain high schools, though not required to do so; and those not maintaining such high schools are required to pay the tuition fees of qualified students within their limits who go elsewhere for high school instruction. The poorer towns receive help from the State in paying for tuition in outside schools. The high schools must offer a four-year course, of 40 weeks a year, and they must prepare pupils for the State normal schools, and for higher scientific schools and colleges. The organization of the University of the State of New York has been mentioned. It presents the most thoroughly organized State system of secondary education yet developed on American soil. All incorporated secondary schools in the State and all other secondary schools which may, after official inspection, be admitted to membership by the regents, are institutions of the university. Of the six departments into which the work of the regents is divided the college and the high school departments are under one department director, assisted by nine inspectors of schools and by a large staff of examiners. The regents distributed in 1898 a total of \$209,250.48 in State funds to the secondary schools of the State. The method of distribution is as follows: (a) \$100 is allotted to each school approved by the regents, without regard to its size or special attainments. (b) One cent is allowed for each day's attendance of each student in such schools; provided that each student so counted must hold a "regent's preliminary certificate" for admission to the school, or the school must be approved by two university inspectors, as having a higher entrance requirement than the minimum prescribed for the preliminary certificate. (c) The State duplicates the amount raised by the schools for the purchase of approved books and apparatus up to the sum of \$500 a year for any one school. (d) Grants are made on the basis of credentials obtained by pupils in the school who pass the regents' examinations—a method of "payment by results." In 1898, of the money distributed by the regents to secondary schools, about 25 per cent came under item (a); 22 per cent under item (b); 19 per cent under item (c); and 34 per cent under item (d). The regents' examinations are held three times a year. The diplomas issued by the regents to graduates of secondary schools are accepted by Cornell University and by other institutions of higher education in the State, in lieu of entrance examinations in the subjects which they cover. A syllabus is issued by the regents for the guidance of instruction in university institutions. There is free consultation between the officers of the university and the instructors in the schools with reference to the contents of this syllabus. An annual university convocation, in which the representatives of all divisions of the university meet for public discussion, forms one of the notable educational gatherings of the country.

In Maryland, a law of the year 1865 swept away the old academy system, and substituted for it a system of county high schools. This radical

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change was followed by a reaction. Later legislation took a middle course. A law enacted in 1872 provided for the establishment of high schools in the several counties, to be under the control of the boards of county school commissioners, or of district boards appointed by them. Each of these high schools must be "visited and examined annually by the principal of the State normal school, or a professor thereof," and must also be visited once in each term by the county examiner. The support of these high schools is provided for by the county school commissioners, who set apart for that purpose a portion of the ordinary school funds received from the State and the county. About 20 academies continue to receive direct donations from the treasury of the State.

In Indiana there is virtually a system of university accrediting of high schools, the administration of which has been turned over to the State Board of Education. In July 1873 the board of trustees of Indiana University adopted a resolution to the effect that a certificate "from certain high schools" should entitle the bearer to admission to the freshman class. In August of the same year, the State Board of Education adopted plans under which the high schools which were worthy of such recognition should be designated and commissioned. In 1888 the following order was passed: "That hereafter no high school commission be granted except on a favorable report in writing, to be made to the State Board of Education, by some member of the State Board, who shall visit the high school in question as a committee of the State Board for that purpose. That all the high schools now in commission be visited by committees of the board as soon as may be, and that the present list be modified by the reports from such visitation. That in case of change of superintendent in any commissioned high school, the commission then existing shall be in force until a visitation shall be made by a committee of the State Board." By such simple means and without specific legal enactment, an important system of high schools has been built up. These schools rest upon a statutory provision authorizing local school authorities to provide for the teaching, not only of the elementary branches, in English, but also of "such other branches of learning and other languages as the advancement of the pupils may require." They are supported in the same manner as the elementary schools.

The Wisconsin State system of free high schools was established in 1875. It provides for the maintenance of high schools by towns, incorporated villages, cities, or school districts or sub-districts containing incorporated villages or two-department graded schools within their limits. Two or more adjoining towns, or one or more towns and an incorporated village, may unite in establishing and maintaining a high school. These schools are managed by local high school boards, commonly identical with the boards for elementary schools. They are supported primarily by local taxation; but a district is entitled to receive from the general fund of the State a sum not exceeding one half the amount actually expended for instruction in the high school of such district, and not exceeding \$500 in any one year, if the school has been kept in accordance with certain requirements prescribed by law, and if the total amount paid from the State treasury for this purpose in any

one year does not exceed \$50,000. Such a school is under the direct inspection and oversight of the State superintendent. To receive State aid, a school must establish and maintain a course of study approved by that official, and must be taught by teachers whose certificates he has approved. An effort has been made in Wisconsin to encourage high schools in the less thickly settled portions of the State. But it has been found difficult to promote the general establishment of such schools by other units of civil administration than those which establish and maintain elementary schools. In Wisconsin the elementary schools are governed and supported by district school authorities, and not by township boards.

Minnesota may be taken as another type of secondary school control as that State has maintained a State system of high schools since 1881. At the head of this system stands the State high school board, which appoints a high school inspector and a graded school inspector. Any public high school in the State may become a State high school, and is then entitled to receive from the State the sum of \$800 annually. To be a State high school, it must admit students of either sex from any part of the State without charge for tuition, must provide a course of study covering the requirements for admission to the University of Minnesota, and must be subject to the State rules and open to inspection. The State high school board conducts a written examination of classes in the schools twice a year. Students who successfully pass such examinations receive certificates for the subjects so covered; and these certificates are accepted by the university and the normal schools of the State in lieu of entrance examinations in the subjects specified. The taking of this State examination is ordinarily optional with the school; but the State board may require a school to take an examination as a part of the annual inspection. Perhaps the most significant thing about the Minnesota system is the encouragement it gives to high schools in the smaller towns. Communities all over the State tax themselves freely to supplement the bounty distributed by the State board.

Several other States have made marked advance within the past few years in the direction of improved systems of secondary schools, improvements gained through the untiring efforts of devoted friends of education.

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**Education in Latin-America.** The peculiar nature of the problems in the field of education which the Latin-American republics have been called upon to solve may be shown most conveniently if we consider, (1) the experience of Mexico, and (2) that of Brazil. Characteristic differences in the educational systems of other Latin-American countries are mentioned where the context serves to explain them—that is, in the articles dealing generally with the history and institutions of those countries. In Mexico, subsequent to colonial legislation the first law on the subject of education, in 1823, was based upon liberal principles and contained an excellent plan of study for use in public schools; it provoked a revolution, however, by appropriating some real estate belonging to the Church, suppressing the clerical

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university, and exempting public education from the control of the clergy. The clerical party succeeded in re-establishing the university under direction of the clergy and restoring to the Church its confiscated property. Wars, civil and foreign, and the undetermined relation of the States to the central government, stopped or hindered educational progress, but in 1843 the government established uniform methods of teaching and a graded system of classes in schools. An effort was made in the same year to centralize the management of the educational system in the city of Mexico. Three years afterward the States resumed their proper share of authority in this matter. Between this time and 1857 the country was distressed by revolutions, dictatorships, and the war with the United States which resulted in the loss of more than two fifths of the Mexican territory; but when the constitutional government was established (1857) the educational law of 1843 was restored. In 1861 Ramirez, minister of justice, secured the passage of another law on this subject, liberal in spirit like that of 1833. War with France (1862-7) made it impossible to carry out the provisions of that law; in December 1867, however, the establishments for secondary instruction were reopened, and an effort was made to improve the primary schools and to bring the methods of teaching into harmony with republican principles. The privileges of education were, by the law of 15 May 1869, extended to all social classes, and primary instruction was made obligatory in the federal district and territories. Thus we find that the triumph of liberal theories was preceded by a contest which lasted for 36 years, at least. "The results of this triumph," as Mr. Hilder well says, "have been the complete separation of church and state, universal religious toleration, a constitution based on the broadest republican opinions, a free press, and free schools." Meantime the great mass of the people had remained ignorant and untrained. The task of the government was therefore exceedingly difficult. A plan hopefully formulated in 1873 could not be carried out; in fact, the practical device for producing an impression upon the millions of utterly indifferent common people appears first in a law of 1888 requiring all persons having control of minors to *prove* that the children in their care had received the necessary primary education; the penalty for violation or neglect of this order being a fine (10 cents to \$10) and imprisonment for not more than 10 days. In 1889 Baranda, minister of justice and education, called a convention of prominent educators and representatives of the different States of the republic. The convention met in the city of Mexico 28 November, and its sessions continued until 31 March 1890. A second educational convention met 1 Dec. 1890 and remained in session until March 1891. The conclusions reached in these pedagogic congresses were embodied in the law of 21 March 1891, which provides that instruction in the public schools shall be secular and gratuitous, and that primary elementary instruction (obligatory for children of both sexes from 6 to 12 years of age) may be obtained in any public or private school, or from private tutors. In the federal district and territories committees have been formed to see that the law in respect to compulsory education is complied with; in the States, however, "and particularly the less

populous ones, and where the Indians predominate, compulsory attendance, although recognized by law," it is said, "can not yet be enforced." For the uncivilized Indians of remote districts special schools are provided in which the teachers are young members of the same tribes, trained in normal colleges. The government has organized many schools and colleges in which higher education and scientific training may be obtained. The principal institutions are: National College of Engineers and Mining (all classes open to the public, and no fee required either on entrance or at the time of receiving degree or diploma); Medical College; National Medical Institute (established by the government 1888-90, for the study of the flora, fauna, climatology, and geography of the country, and their practical application to the science of medicine); National College of Agriculture and Veterinary Surgery; Commercial College; National School of Fine Arts; National Conservatory of Music; National Law School; National Military College; normal schools for training male and female teachers; National School of Arts and Trades for Men (manual training and a higher education for workingmen); the same for women (founded by President Juarez 1871, for the purpose of improving the social condition of workingwomen and affording them an opportunity to fit themselves for good business positions); National School for the Blind; a school for deaf-mutes; industrial school for orphan boys; La Paz College (for women); Correctional School of Trades and Professions (for the reformation of boys under 18); and the National Library, containing 170,000 volumes, the nucleus of the collection being formed by the books and documents which came into the government's possession through the suppression of ecclesiastical colleges. There are museums in nearly every State, supported by the local (State) governments. The principal cities, Toluca, Morelia, Guadalajara, Guanajuato, Puebla, Merida, and others, have literary and scientific associations, and a score of such societies exist in the federal district. Of these the most influential is El Liceo Hidalgo, which has for its aim the encouragement of native talent. President Diaz stated in his message of 1 April 1895 that there were about 8,000 public schools for primary education in the republic, with 500,000 scholars; that the amount appropriated by the government for educational purposes was about \$3,500,000 per annum; and that in the federal district there were 62 private free schools, and 195 private schools in which pupils paid for their education. The influence of the government's educational policy since 1857 has been very marked, in spite of the difficulties we have mentioned; and the good results are seen especially in the improved intellectual status of women. Mr. Hilder says that "there is now a very large and influential middle class, composed of both Indian and mixed races, which is every year, by the spread of education, gaining accessions from the humbler class"—the latter making good progress under the new order of things.

Brazil was notably unprogressive during the three centuries of her existence as a colony, while her intercourse with the outside world was controlled by Portugal, though an interest in art and letters awoke when the Portuguese court was transferred to South America (see

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BRAZIL). King John introduced printing-presses, established schools, and promoted arts and sciences; the country was visited by large numbers of foreigners, including distinguished writers and scholars, and all this tended to improve the manners and enlarge the ideas of the people. Moreover, when the Cortes of Portugal recalled the king (1821), he left his historical library, which became the nucleus of the great public library at Rio de Janeiro. Independence was declared 7 Sept. 1822, and by a decree in October 1823 any citizen was authorized to establish a primary school without obtaining a special license—a radical departure from the old custom of entrusting elementary education to the clergy alone. In 1827 a law was passed authorizing the establishment of public primary schools in all the cities and towns, but little progress was made until 1854, when a thorough reorganization of the school system was effected. During the second half of the century a development has taken place which is certainly admirable; and no one will be disposed to withhold his commendation who reflects that the country was obliged at the same time to deal with such problems as the Paraguayan war, the emancipation of the slaves, and the change in the form of government from monarchy to republic. Under the constitution the instruction given in public institutions is secular, gratuitous (in primary schools), and at the charge of the various States and municipalities. In some of the States primary instruction is compulsory. An excellent standard has been established in primary schools (except those of remote districts, which are decidedly inferior). Pupils are admitted to the first-grade schools from 7 to 13 years of age, and to the second-grade schools from 13 to 15 years of age. There are separate schools for girls, who are admitted to the first grade at the age of 8 years. The course of study in the first grade is: reading, writing, the Portuguese language, arithmetic as far as the rule of three, metric system, elements of geography and history (especially of Brazil), introductory lessons in physical science and natural history, moral and civic instruction, drawing, elements of music, gymnastics and military exercises, manual training for boys and needle-work for girls, and practical lessons in surveying. The number of primary schools in the republic was recently stated to be 7,017, and the number of pupils about 300,000. There are several hundred private schools. Secondary education is provided in the *Gymnasio Nacional* (two establishments thus named in the capital; course of study seven years). National institutions for higher education are: two law schools (those of São Paulo and Pernambuco); two schools of medicine and pharmacy (at Rio de Janeiro and Bahia); the polytechnic school at Rio de Janeiro; the school of mines at Ouro Preto in the State of Minas Geraes; military and naval schools; the National Academy of Fine Arts, Institute of Music, and Museum; and finally the National Library, containing an immense collection of books and maps, manuscripts, prints, and coins.

Consult: 'Education in Mexico and Central America,' by F. F. Hilder, in report of secretary of interior on education (1896), Vol. V., Part I., Washington, Government Printing Office, 1897; also 'Education in Brazil,' same, in re-

ports of department of interior, Commissioner of Education (1898), Vol. I., Washington, 1899.

MARRION WILCOX,

**Education of Defectives.** See DEFECTIVES, EDUCATION OF; BLIND; DEAF; DUMB; FEEBLE-MINDED, etc.

**Education of Women.** See WOMAN, EDUCATION OF.

**Educational Land Grants.** See COLLEGES, LAND GRANT.

**Educational Organization and Administration.** The first white settlers who came to America were from the more civilized European peoples, who had already made some progress in the direction of popular education. The most potent influences upon American civic institutions were English and Dutch. English colleges and fitting schools were maintained for the training of young men of noble birth for places under the government and in the government church, but there were no common schools for all. The Dutch had gone farther than the English; they had just waged a war for civil and religious liberty which had enlarged their freedom and quickened their activities; they had become the greatest sailors and the foremost manufacturers in the world; and they had established the government policy of maintaining not only colleges, but common schools for all. English and Dutch each brought their national educational ideas with them. The English colony in Massachusetts followed the English educational policy; and set up a college to train their aristocracy for places in the state and the church. The Dutch, more dependent upon their government over the sea, at once set up elementary schools at public cost and common to all. In a few years the English overthrew the little Dutch government and almost obliterated the elementary schools. For a century the English royal governors and the Dutch colonial legislatures struggled over the matter of common schools. The government was too strong for the humble people; little educational progress was made. Near the close of that century the government established King's College to educate sons of noble birth and prevent the spread of republican ideas. The Revolution of 1776 changed all. In fighting together for national independence the different peoples assimilated and became Americans in the new sense. They realized that education must be encouraged, and, so far as practicable, made universal under a democracy in which the rights of opportunity were to be equal. But they began to be interested in education because they saw that schools would help the individual and so promote virtue and extend religion. It did not occur to them at first that the safety of the new form of government was associated with the diffusion of learning, for the suffrage was not universal at the beginning of independent government in America. Therefore, it was understood to be the function of parents to provide education for their children. Schools were partnership affairs between people who had children in their care. They apportioned the expense among themselves. But it was soon seen that many who had children to educate would neglect them to avoid contributing to the support of the school. Besides the schools were very indifferent affairs. If they were to be of any account they must have

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recognition and encouragement from government. Encouragement was given by official and legislative declarations in their behalf and by authorizing townships to use various surplus funds for the benefit of the schools. It was a greater step for the townships to require parents and guardians to maintain schools, and a still greater one to adopt the principle that every child was entitled to an elementary education, that this was for the safety of the state, that therefore the state was bound to see that schools were provided for all, and that all the property of all the people should contribute alike to their support. Perhaps it was even a greater step to provide secondary and collegiate, and in many cases professional and technical, training at the public cost.

Although there was no educational system in the United States at the beginning of the 19th century, there is now one throughout the country, free and flexible, adaptable to local conditions, and with the elements of a complete and symmetrical system. The parts of this system may be designated as follows:

(a) Free public elementary schools in reach of every home in the land.

(b) Free public high schools, or secondary schools, in every considerable town.

(c) Free land grant colleges, with special reference to the agricultural and mechanical arts, in all the States.

(d) Free State universities in practically all of the southern States and all the States west of Pennsylvania.

(e) Free normal schools, or training schools for teachers, in practically every State.

(f) Free schools for defectives, in substantially all of the States.

(g) National academies for training officers for the army and navy.

(h) A vast number of private kindergartens, music and art schools, commercial schools, industrial schools, professional schools, denominational colleges, with a half dozen leading and privately endowed universities.

This educational system is held in the control of the people, and so far as practicable in the control of local assemblages. In spite of modern tendencies toward centralization of management, the conspicuous characteristic of the system has always been that elementary and secondary schools are largely controlled and directed by each community.

*The School District.*—The "school district" is the oldest and the most primary form of school organization, and the smallest civil division of our political system. It resulted from the disposition of neighboring families to associate for the maintenance of a school. Later it was recognized by law. It ordinarily accommodates but a few families, and is better adapted to the country than to town or city. The "district system" is in operation in most of the States; in New York there are more than 11,000 and in Illinois more than 12,000 school districts. Their government is the most simple and democratic that can be imagined. It is controlled by school meetings held annually or oftener and composed of resident legal voters, in many of the States including women, especially of property holders. These meetings vote repairs and appliances for the school, erect new schoolhouses, and elect officers, one or more, commonly called trustees or directors, who are required to em-

ploy the teacher and have general oversight of the school. Although much has been said against the district system, it cannot be denied that the system has had much to commend it, for it suits the conditions of country life; makes schools adapted to the thought and wants of the people; educates the people themselves in civic spirit and patriotism; and affords a meeting-place for the people. The district school ordinarily has been as good as a free and primitive people would sustain or could profit by. The teachers have generally been young and inexperienced, but never mere mechanical automata, and as a rule they have proved makers of opinion and leaders of action upon a considerable field. Certainly the work has lacked system, continuity and progressiveness, but the pupils have not suffered seriously, in comparison with the children living in the towns. The district system has sufficed well for them and it is to be spoken of with respect, for it has exerted a marked influence upon our citizenship, and has given strong and wholesome impulses in all the affairs of the nation.

*The Township System.*—In the first half of the last century the general educational purpose was to perfect the district system; the tendency in the latter half was unmistakably to merge it into an organization covering a larger area, and capable of larger undertakings. The cause of this has been the desire for larger schools, taught by teachers better prepared, and capable of broader and better work, and a purpose to distribute educational advantages more evenly. Accordingly, in most of the States the township system has already supplanted the district organization. The township system makes the township the unit of school government. It is administered by officers chosen at annual town meetings, or sometimes by central boards, the members of which are chosen by the electors of different sub-districts. In any event, the board has charge of all the elementary schools of the township, and of the township high school, if there is one. The board provides buildings and cares for them, supplies the furnishings and appliances, employs teachers, and regulates the general operations of the schools. Of course the township system is much less formally democratic and much more centralized than the district system. It has doubtless produced better schools and schools of more uniform excellence. One of its most beneficent influences is the multiplication of township high schools.

It has many advantages over the district system for a people who are ready for it, and it is a step toward that general centralization in management and greater uniformity of method so manifest throughout the school system of the United States.

*The County System.*—The southern States, for the most part, have a county system of school administration. This has resulted from the general system of county government prevalent in the southern States and easily traceable to historic causes.

The county system is not constituted identically in all of the southern States of the Union. In Georgia, for example, the grand jury of each county selects from the freeholders five persons to comprise the county board of education; in North Carolina the justices of the peace and county commissioners of each county appoint



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such a county board of education; in Florida such a board is elected by the people biennially; and elsewhere a county commissioner or superintendent of schools is the responsible authority for managing the schools of the county. In any case the unit of territory for the administration of the schools is the county, and county officials locate sites, provide buildings, select text-books, prescribe the course of work, examine and appoint teachers, and do all the things which are within the functions of district or township trustees or city boards of education in the northern States.

*The City School Systems.*—In cities where it is difficult for people to meet to fix the policies and manage the business of the schools, or to choose officers to manage the schools, the State legislatures make special laws for city schools. In some States these laws are uniform for all cities of a certain population, but more often each city has gone to the legislature and procured the enactment of such statutes as seemed suited to the immediate circumstances, so that there is no uniform or general system of public school administration in the American cities. But in nearly every case there is a board of education charged with the management of the schools; these boards differ in constitution and in legal functions in different cities. Usually boards of education are elected by the people, on a general city ticket, or by wards or sub-districts; and either at a general or municipal election, or at special elections. But in the larger cities, the board is appointed by the mayor, or by mayor and city council. In a few instances it is appointed by the city councils. It must be said that there has been much dissatisfaction with the way school affairs have been managed in the larger cities, where there have been many and serious complaints of misuse of funds, of neglect of property, of appointment of unfit teachers, and of general incapacity, or worse, on the part of the boards. All this has come from the amounts of money that are involved and the number of appointments that are constantly to be made. More than \$100,000,000 is paid annually for teachers' wages alone in the United States. People who are needy have sought positions as teachers without much reference to preparation, and the kindly disposed have aided them without any apparent appreciation of the injury they were doing to the highest interests of their neighbors. Men engaged in managing the organizations of the different political parties have undertaken to control appointments in the interests of their party machines. And downright scoundrels have infested the school organization in some places for the sake of plunder. As cities have grown in size and multiplied in numbers the more scandal there has been. But so has the determination of the people strengthened to remedy difficulties.

Especially important is a report of the Committee of Fifteen of the National Educational Association, which closes with the following suggestions:

First. The affairs of the school should not be mixed up with partisan contests or municipal business.

Second. There should be a sharp distinction between legislative functions and executive duties.

Third. Legislative functions should be clearly fixed by statute and be exercised by a comparatively small board, each member of which is representative of the whole city. This board, within statutory limitations, should determine the policy of the system, levy taxes, and control the expenditures. It should make no appointments. Every act should be by a recorded resolution. It seems preferable that this board be created by appointment rather than election, and that it be constituted of two branches acting against each other.

Fourth. Administration should be separated into two great independent departments, one of which manages the business interests and the other of which supervises the instruction. Each of these should be wholly directed by a single official who is vested with ample authority and charged with full responsibility for sound administration.

Fifth. The chief executive officer on the business side should be charged with the care of all property and with the duty of keeping it in suitable condition: he should provide all necessary furnishings and appliances: he should make all agreements and see that they are properly performed: he should appoint all assistants, janitors, and workmen. In a word, he should do all that the law contemplates and all that the board authorizes, concerning the business affairs of the school system, and when anything goes wrong he should answer for it. He may be appointed by the board, but it is preferable that he be chosen in the same manner as the members of the board and be given a veto upon the acts of the board.

Sixth. The chief executive officer of the department of instruction should be given a long term and may be appointed by the board. If the board is constituted of two branches, he should be nominated by the business executive and confirmed by the legislative branch. Once appointed he should be independent. He should appoint all authorized assistants and teachers from an eligible list to be constituted as provided by law. He should assign to duties and discontinue services for cause, at his discretion. He should determine all matters relating to instruction. He should be charged with the responsibility of developing a professional and enthusiastic teaching force, and of making all the teaching scientific and forceful. He must perfect the organization of his department and make and carry out plans to accomplish this. If he cannot do this in a reasonable time he should be superseded by one who can.

In the present scheme the powers of the city boards of education are very broad, almost without limits as to the management of the schools. They do everything but decide the amount of money which shall be raised for the schools, and sometimes do that. Of course these independent and large prerogatives are exceedingly advantageous to educational progress when exercised by good men; but it is not to be disguised that in some of the foremost cities they have fallen into hands which are corrupt, but more often into the hands of men who do not see the importance of applying pedagogical principles to instruction, and who are used by designing persons for partisan, selfish or corrupt purposes. But notwithstanding all hindrances, the issue is being joined and the battle will be



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fought out to a successful result. There can be but one outcome. The forces of decency and progress always prevail in the end.

The demands of the friends of popular education in our great cities are for a plan of organization separating legislative and executive functions, putting the interests of teachers upon the merit basis and leaving them free to apply pedagogical principles to the instruction, giving large authority to officers and teachers, but locating responsibility and ousting the incompetent or corrupt.

*The States and the Schools.*—Since the American school system is supported wholly by taxation, it depends upon the exercise of a sovereign power. The provision and supervision of schools is a power lodged in the State, and the school system has a legal organization peculiar to each State. This dependence upon State authority has developed a system which tends toward the equalization of school privileges within each State. Of the improvement brought about by intervention on the part of the State in local control, there can be no doubt. In many cases State school funds have been created, or large sums are raised by general levy each year, which are distributed so as to give the most aid to the sections which are poorest and most need it. In the State of New York, for example, the cities pay more than \$500,000 every year to the support of the schools in the country districts. Moreover, excellent normal schools and, in the South and West, great State universities are sustained as parts of the State school systems. In 10 universities of the north-central division of States there are more than 20,000 in college and professional courses, and the work is of as high grade and of as broad range as in the oldest universities of the country. These things exert strong influences upon the sentiment of the people and increase their respect for the State authority over schools. The application of State authority to all schools supported by public moneys of course makes them better and more alike. Whims of local settlements disappear. Schoolhouses are better. More is done for the preparation of teachers, and more uniform exactions are put upon candidates for the teaching service. The courses of study are more quickly and symmetrically improved. There is criticism and stimulus from a common centre for all of the educational work of the State. The different States have gone to very different lengths in exercising their authority. The State government has, of course, not been disposed to go farther than the people were willing, for all government is by the people. The thought of the people in the different States has been somewhat influenced by considerations which arise out of their early history, but doubtless in most cases it is predicated upon their later experiences.

All State constitutions now contain provisions relating to popular education. This was not true of the original constitutions of the older States, for when they were adopted the maintenance of schools was looked upon as a personal or local rather than a State concern. But later amendments introduced such provisions into all older State constitutions. And all newer ones contained strong and elaborate sections, making it a fundamental duty of the government they establish to encourage education and provide schools for all. All the States

have legislated much in reference to schools, and there is scarcely a session of one of the State legislatures in which they do not receive considerable attention. In all the States there is some sort of a State school organization established by law. In practically all there is an officer known as State superintendent of public instruction, or State school commissioner. In some there is a State Board of Education. In New York there is a State Board of Regents in charge of private academies, in some measure of public secondary schools, and of all higher institutions; and also a State Superintendent of Public Instruction, with authority over the elementary schools and in a large measure over the public high schools. The officer last referred to is probably vested with larger authority than any other one educational official in the country. He apportion the State school funds; determines the conditions of admission, the courses of work, and the employment of teachers; audits accounts of the 12 normal schools of the State; has unlimited authority over the examination and certification of teachers; regulates the official action of the school commissioners in all of the assembly districts of the State; appoints teachers' institutes, arranges the work, names the instructors, and pays the bills; determines the boundaries of school districts; and provides schools for the defective classes and for the seven Indian reservations yet remaining in the State. Besides he may condemn schoolhouses and require new ones to be built; and may direct new furnishings to be provided. He is a member of the State Board of Regents and of the board of trustees of Cornell University. He may entertain appeals by any person conceiving himself aggrieved from any order or proceeding of local school officials, determine the practice therein, and make final disposition of the matter in dispute, and his decision cannot be "called in question in any court or in any other place." All this, with the splendid organization of the State Board of Regents, provides New York with a more complete and elaborate educational organization than any other American State. Some think it more elaborate and authoritative than necessary. Certainly it is exceptional among the States, for most of them undertake to regulate school affairs very little, and usually the State Board of Education only controls the purely State educational institutions, and the principal functions of the leading educational official of the State are to inspire action, gather statistics, and disseminate information. However, there can be no doubt that the general tendency is toward greater centralization. The overwhelming current of legislation and of the decisions of the courts is making it imperative, being practically in accord, and to the effect that in each State the school system is not local, but general; not individual schools controlled by separate communities, but a closely related system of schools which has become a State system and is entirely under State authority; and holding local school officials as agents of the State for the administration of a State system of education. The granting of aid by the State implies the right of the State to name the conditions upon which the aid shall be received, and the duty to see that the exercise of such powers shall result in equal advantages to all. Despite of differences all the States ap-

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preciate the fact that a constitutional self-governing state exists for the moral and intellectual advantage of every citizen. They have employed and will continue to employ different methods; but all have the highest authority and the supreme responsibility in the matter. And it is the purpose of the people and the law of most of the States not only that such educational opportunities shall be provided for every American child, but that every one shall be required to take advantage of them. Compulsory attendance laws have been enacted in most of the States. These are not as carefully framed as a good knowledge of educational administration might very easily lead them to be, and they are not as completely enforced as the true interests of many unfortunate children require. The right of compulsory education on the part of the State has met with considerable opposition and is still a much disputed question.

*General Government and Education.*—The Federal government has never exercised any control over the public educational work of the country. But it has never been indifferent thereto. It has shown its interest at different times by generous gifts to education and by the organization of a bureau of education to gather and disseminate the fullest information from all the States, and from foreign nations. The gifts of the United States to the several States to encourage schools have been in the form of land grants from the public domain. In the sale of public lands the practice of reserving one lot in every township "for the maintenance of public schools within the township" has uniformly been followed. In 1786 officers of the Revolutionary army petitioned Congress for the right to settle territory north and west of the Ohio River. A committee reported a bill in favor of granting the request, which provided that one section in each township should be reserved for common schools, one section for the support of religion, and four townships for the support of a university. This was modified so as to give one section for the support of religion, one for common schools, and two townships for the support of a "literary institution to be applied to the intended object by the legislature of the State." This provision, coupled with the splendid declaration that "religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged," foreshadowed the general disposition and policy of the central government and made the "Ordinance of 1787 for the government of the Northwest Territory" famous. The precedent here established became national policy, and after the year 1800 each State admitted to the Union, with the exception of Maine, Texas, and West Virginia, received two or more townships of land for the founding of a university. In 1836 Congress passed an act distributing to the several States the surplus funds in the treasury. In all \$28,101,645 was so distributed, and in a number of the States this was devoted to educational uses. But the most noble, timely, and carefully guarded gift of the Federal government was embodied in the Land Grant Act of 1862 for colleges of agriculture and the mechanic arts, which gave to each State 30,000 acres of land for each senator and representative in Congress to which

the State was entitled under the census of 1860, for the purpose of founding "at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States shall respectively prescribe, in order to promote the liberal education of the industrial classes in the several pursuits and professions of life." This act has been added to by other congressional enactments and the proceeds of the sales of lands have been generously supplemented by the State legislatures until great peoples' colleges and universities have arisen in all of the States.

The work of the United States Bureau of Education is a most exact, stimulating, and beneficent one. Without exercising any authority, it is untiring and scientific in gathering data, in the philosophic treatment of educational subjects, and in furnishing the fullest information upon every conceivable phase of educational activity to whomsoever would accept it. It has become the great educational clearing-house of the world. Its commissioners have been eminent men and great educational leaders.

*Private Institutions.*—Besides public schools there is a large number of other schools which comprise an important part of the educational system of the country and are of course subject to its laws. Any statement concerning American school organization and administration, even of the most general character, would be incomplete which did not cover these. In the first half of the last century many private "academies" or "seminaries" sprang up where the country had become at all settled. This was in response to a demand from people who could not get what they wanted in the common schools. A teacher with a little more than ordinary gifts could open one of these private schools and soon have an abundance of pupils and a profitable income. But most of these schools served their purpose and gave way to new public high schools. Some remain and continue to meet the desires of certain families who prefer their somewhat exclusive ways. A considerable number have been adopted by their States and developed into State normal schools, and not a few have by their own natural force grown into literary colleges. In recent years innumerable schools have arisen out of private enterprise. Every conceivable interest, professional, technical, industrial, and commercial, has produced a school to promote its own ends.

All such schools operate independently of the States in which they exist. The States do not interfere with them, as they ask no public support. Some of them hold charters granted by the legislature, and more secure recognized standing by organizing under general corporation laws enacted to cover all such enterprises. In some cases the States distribute public moneys to some of these institutions by way of encouragement, and perhaps impose certain conditions upon which they shall be eligible to share in such distributions. But ordinarily a State does no more than protect its own good name against occasional impostors. New York, for example, has prohibited the use of the name "college" or "university" except when the requirements of the State Board of Regents are met. All reputable institutions

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desire reasonable supervision, for it certifies their respectability and constitutes them a part of the public educational system of the State.

*Expert Supervision.*—From the beginning the laws have provided methods for certifying persons deemed to be qualified to teach in the schools. This has ordinarily been among the functions of State, city, and county superintendents or commissioners. Sometimes boards of examiners have been created whose only duty was to examine and certificate teachers. The function of certifying and that of employing teachers have, for obvious reasons, not commonly been lodged in the same officials. Superintendents began to be provided for by law in the early part of the 19th century. The first State superintendency was established by New York in 1812. Other States took similar action in the next 30 years. Town, city, and county superintendencies came along rapidly, and by or soon after the middle of the century had been set in operation in most parts of the then settled country. The main duty of these officials in the earlier days was to examine candidates for teaching, report statistics, and make addresses on educational occasions. In later years, however, they are held in considerable measure responsible for the quality of the teaching. In country districts superintendents hold institutes, visit schools, commend and criticise the teaching, and exert every effort to promote the efficiency of schools, so that a discreet and active county superintendent comes to exert almost a controlling influence over the school affairs of his county. In the cities, and particularly the larger ones, the problem is much more difficult. Because of the greater number of teachers, the task of securing uniform excellence is much enlarged. The schools are less homogeneous and instruction less easy. Frequently the superintendent cannot know the personal qualities of each teacher, or even visit all of the schools. Yet a system must be organized which, through the aid of assistants, will advise the superintendent's office fully of the work of every teacher. All teachers must be upon the merit basis, the most deserving must be advanced in rank and pay as rapidly as practicable, and the weak must be helped and trained into efficiency or removed from their positions. The laws are coming to recognize the responsibilities and difficulties of the superintendent's position, and are continually throwing about that officer additional safeguards and giving him larger powers and greater freedom of action. And the good cause of education against political manipulation is making substantial progress. The law books of all of the States show provisions recognizing the professional school superintendent; in many of the States they contain provisions directing and protecting his work: and in some they confer upon him entire authority over the appointment, assignment and removal of teachers, and impose upon him entire responsibility for the quality of the teaching. It is this professional supervision which has given the American schools their peculiar spirit. As the people have come to know the worth of good teaching they have favored closer supervision over the teaching. All this is yearly becoming more and more apparent in the laws, and it is advancing the great body of American teachers along philosophical lines more steadily and rapidly than

any other great body of teachers in the world is advancing.

In conclusion a few facts touching the great school system, the legal organization of which we have briefly tried to sketch, and which has produced that organization and in turn has in part been produced by it, will be of interest. The enrolment of pupils in the State common schools alone in 1899-1900 was nearly 15,350,000. These schools were kept open an average of 140.5 days in the year. The number of teachers employed was more than 420,000, and the running expenses for the year about \$213,000,000. Laws making attendance at school compulsory have been enacted in 32 States and Territories.

The United States Bureau of Education, to which I am indebted for the foregoing figures and much other information, is aided by a corps of 15,000 voluntary correspondents who furnish printed reports and catalogues and cheerfully answer the bureau's inquiries upon every phase of educational work.

It is of course difficult for one not familiar with American institutions and American ways to understand or appreciate the American school system. To him it seems anything but a system. It is a product of conditions in a new land, and it is adapted to those conditions. It is at once expressive of the American spirit and it is energizing, culturing and ennobling that spirit. It is settling down to an orderly and symmetrical institution, it is becoming scientific, and it is doing its work efficiently. It exerts a telling influence upon every person in the land, and is proving that it is supplying an education broad enough and of a kind to support free institutions.

ANDREW SLOAN DRAPER,  
*President University of Illinois.*

**Edward the Elder**, king of England: b. about 870; d. Farndon, Northamptonshire, 925. He was a son of Alfred the Great, and succeeded his father in 901. Ethelwald, the son of his father's elder brother, claimed the crown; and an insurrection took place in his favor, but it ended with the death of Ethelwald in battle. The reign of Edward was further distinguished by successes over the Anglicized and foreign Danes. He fortified many inland towns, acquired dominion over Northumbria and East Anglia, and subdued several of the Welsh tribes.

**Edward** (surnamed the "MARTYR"), king of England: b. about 963; d. Corfe Castle 18 March 979. He was a son of Edgar, and succeeded his father in 975. His stepmother, Elfrida, wished to raise her own son, Ethelred, to the throne, but was opposed by Dunstan, through whose exertions Edward was peaceably crowned. His short reign was chiefly distinguished by the disputes between Dunstan and the foreign monks on one side, and the secular clergy on the other. Hunting one day in Dorsetshire he was separated from his attendants, and repaired to Corfe Castle, where Elfrida resided. He requested a glass of liquor, and as he was drinking on horseback one of Elfrida's servants gave him a deep stab behind. He immediately set spurs to his horse, but, fainting from loss of blood, was dragged in the stirrup until he died. The pity caused by his innocence and misfortune induced the people to regard him as a martyr.

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**Edward** (surnamed the "CONFESSOR"), king of England: b. Islip, Oxfordshire, about 1004; d. 5 Jan. 1066. He was a younger son of Ethelred II. On the death of his maternal brother, Hardicanute the Dane, in 1041, he was called to the throne, and thus renewed the Saxon line. He was not the immediate heir, as his brother, Edmund Ironside, had left sons; but as he received the support of Godwin, earl of Kent, on condition of marrying his daughter, Editha, his claim was established. Edward was a mild and virtuous prince, who acquired the love of his subjects by his sanctity and care in the administration of justice. Having been educated in Normandy he introduced so many natives of that country to his court that the French language and manners became prevalent in England to the great disgust of Earl Godwin and his sons. A rebellion took place, and Edward was forced to dismiss his foreign favorites. Perceiving that the youth and weakness of his chosen heir, Edgar Atheling (q.v.), would not secure the succession against the power and ability of Harold, the son of Godwin, he turned his eyes upon his kinsman, William of Normandy, in whose favor it has been asserted that he executed a will. He died leaving the point of the succession undetermined; and with him ended the Saxon line of kings. He caused a body of laws to be compiled from those of Ethelbert, Ina, and Alfred, which is the supposed source of the common law of England. He was canonized by Alexander III. in 1166.

**Edward I.**, king of England: b. Westminster 17 or 18 June 1239; d. Burgh-le-Sands, near Carlisle, England, 7 July, 1307. He was a son of Henry III., and the contests between his father and the barons called him early into active life, and he finally quelled all resistance to the royal authority by the decisive defeat of Leicester, at the battle of Evesham, in 1265. He then proceeded to Palestine, where he inspired so much terror that an assassin was employed to despatch him, from whom he received a wound in the arm, which, as tradition reports, being supposed to be from a poisoned weapon, was sucked by his faithful consort, Eleanor of Castile. On assuming the government he acted with great vigor in the repression of the lawlessness of the nobles and the corruption in the administration of justice; but often evinced an arbitrary and grasping disposition. In 1274, and again in 1276, he summoned Llewellyn, prince of Wales, to do him homage, and upon his refusal, except on certain conditions, began the war which ended in the annexation of that principality to the English crown in 1283. Edward then spent some time abroad in mediating a peace between the crowns of France and Aragon, and on his return commenced his attempts to destroy the independence of Scotland. After his return from the Scottish expedition in 1295, which terminated in the capture of Baliol, he became involved in a quarrel with his clergy, who, supported by the Pope, refused to submit to a tax which he had imposed on them. Edward forced their compliance by placing them out of the protection of the law. His frequent expedients to raise money at length produced great discontent among the nobles and people also, which obliged him to confirm the great charter and charter of forests, and also to give other securities in favor of public liberty. He

then made a campaign in Flanders against France, which terminated with the recovery of Guienne and his second marriage with Margaret, the sister of King Philip. Meantime new commotions took place in Scotland under the guidance of the celebrated William Wallace. These transactions recalled Edward from Flanders, who hastened to the border with an army of 100,000 men. The ignominious execution of the brave Wallace, in 1305, as a traitor, forms a blot in the character of Edward. Neither did it avail, since Robert Bruce was able, in 1306, to place himself at the head of a new confederacy. Indignant at this determined spirit of resistance Edward vowed revenge against the whole Scottish nation, and, assembling another army, was on the point of passing the border when he was arrested by sickness and death. Few princes have exhibited more vigor in action, or policy in council, than Edward I. His enterprises were directed to permanent advantages rather than to mere personal ambition and temporary splendor. Nor was he less intent upon the internal improvement of his kingdom than its external importance. The laws of the realm obtained so much additional order and precision during his reign that he has been called the "English Justinian." He passed an act of mortmain, protected and encouraged commerce; and in his reign first originated the society of merchant adventurers. The manners of this able sovereign were courteous, and his person majestic, although the disproportionate length of his legs gave him the popular surname of "Longshanks." He left a son and three daughters by his first wife, Eleanor, who died in 1290, and two sons by his second wife, Margaret of France. See Stubbs, 'The Early Plantagenets' (1877); Tout, 'Edward I.' (1893).

**Edward II.**, king of England: b. Caernarvon Castle in 1284; d. Berkeley Castle 21 Sept. 1327. He was the first English Prince of Wales and succeeded his father, Edward I., in 1307. He was of an agreeable figure and mild disposition, but indolent and fond of pleasure. His first step was to recall Piers Gaveston, a young Gascon, whom his father had banished, and whom he created Earl of Cornwall, and married to his niece. He then went to France to espouse the Princess Isabella, to whom he had been contracted by his father, leaving Gaveston guardian of the realm. Soon after his return the barons associated against the favorite, whom they more than once obliged the king to send away. He was, however, as constantly recalled when the immediate danger was over, until an open rebellion took place; and the person of Gaveston being captured, he was executed as a public enemy. In 1314 Edward assembled an immense army to check the progress of Robert Bruce, but was completely defeated at Bannockburn. After the death of Gaveston he selected another favorite, Hugh le Despenser, upon whom he lavished favors of every kind, until the barons again rebelled, and the Parliament dooming Despenser and his father to exile, the king was obliged to confirm the sentence. Edward, however, on this occasion, in concert with the Despensers, contrived to raise troops and attack the barons, at the head of whom was his cousin, the Earl of Lancaster, who, being taken prisoner, was executed at Pomfret. Edward subsequently made another fruitless attempt against

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Scotland, which ended in the conclusion of a truce of thirteen years. In 1324 Queen Isabella went to France, and while there entered into a correspondence with several English fugitives, in whose hatred to the Despensers she participated. Among these was Roger Mortimer, a young baron of the Welsh marches, between whom and Isabella a criminal intercourse followed, in consequence of which the queen was still more determined upon the ruin of her weak and unhappy husband. Having formed an association with all the English malcontents, and aided with a force by the Count of Hainault, she embarked for England in September, 1326, and landed in Suffolk. Her forces seized the Tower of London and other fortresses, captured and executed both the Despensers without trial, and at length took the king prisoner. Edward was confined in Kenilworth Castle, and in January 1327, his deposition was unanimously voted in Parliament, on the ground of incapacity and misgovernment. A resignation of the crown was soon after extorted from him, and he was transferred to Berkeley Castle, where Mortimer despatched two ruffians, who murdered him, in the 20th year of his reign and 43d of his age.

**Edward II.**, an historical tragedy by Christopher Marlowe (1598). It follows history closely in its main lines and is a drama as powerful as it is painful.

**Edward III.**, king of England: b. Windsor 13 Nov. 1312; d. Richmond, Surrey, 21 June 1377. He was a son of Edward II., and on his father's deposition in 1327, was proclaimed king under council of regency, while his mother's paramour, Mortimer, really possessed the principal power in the state. The pride and oppression of Mortimer now became so intolerable that a general confederacy was formed against him. The result was the seizure of Mortimer, who was tried and condemned by a parliament at Westminster, and was executed 29 Nov. 1330. The queen, although treated with outward respect, never again during the remaining 28 years of her life recovered any degree of authority. Edward now turned his attention to Scotland. Assisted by some principal English nobles, Edward Baliol, son of the John Baliol to whom the crown had been awarded by Edward I., raised a force, and defeating the Scots in a great battle, set aside David Bruce, then a minor, and was crowned at Scone in 1332. Baliol being driven away on the departure of his English auxiliaries, applied to Edward, who defeated the regent, Douglas, at the famous battle of Halidon Hill, in July 1333. This victory produced the restoration of Baliol, who was, however, again expelled, and again restored, until the ambition of Edward was called off by a still more splendid object. The crown of France, by the Salic law, having devolved to Philip de Valois, cousin-german to the deceased king Charles the Fair, Edward was induced to claim it in right of his mother, that monarch's sister. Edward, in order to obtain supplies, made concessions to Parliament which he never intended to keep; and finding his territory of Guienne threatened, sent over a force for its defense, and quickly followed himself, accompanied by his son Edward, the famous Black Prince, all his chief nobility, and 30,000 men. The memorable battle of Crécy

followed, 25 Aug. 1346, succeeded by the siege of Calais. In the meantime, David Bruce, having recovered the throne of Scotland, made an incursion, at the head of a large army, into England; but being met at Durham by a much inferior force, raised by Queen Philippa, and headed by Lord Percy, was totally defeated and taken prisoner, with many of his principal nobles. Philippa went over to her husband at Calais, and, by her interference prevented the barbarous execution of Eustache de St. Pierre and five other citizens, whom Edward, on the capitulation of the place, had determined to execute, in revenge for his long detention in the siege. In 1348 a truce was concluded with France. The year 1349 was distinguished by the institution of the order of the Garter, which soon became one of the most illustrious orders of knighthood in Europe. Philip, king of France, dying in 1350, was succeeded by his son John, the commencement of whose reign abounded with intestine commotion, and in 1355 Edward again invaded France on the side of Calais, while the Black Prince at the same time led a large army from Gascony. Both these expeditions were attended with much plunder and devastation; and Edward, being recalled home by a Scottish inroad, soon repelled it, and retaliated by carrying fire and sword from Berwick to Edinburgh. During this time the Prince of Wales had penetrated from Guienne to the heart of France, where he was opposed by King John, at the head of an army nearly five times more numerous than that of the English. The famous battle of Poitiers ensued, in which the French monarch being taken prisoner, Edward held at the same time in captivity the kings of France and Scotland, the most dangerous of his enemies. John was taken to England and treated with the greatest respect; and David was soon after liberated upon ransom. A truce had been made with France after the battle of Poitiers, at the expiration of which, in 1359, Edward once more passed over to Calais with a large army, but at length consented to a peace. Besides the stipulation of a large ransom for King John, several provinces and districts in the southwest of France and neighborhood of Calais were yielded to Edward, who in turn resigned his title to the crown of France and duchy of Normandy. The successor of John, Charles V., invaded the provinces entrusted to Prince Edward, then in the last stage of declining health, and Edward had the mortification of witnessing the gradual loss of all his French possessions, except Bordeaux and Bayonne, and of all his conquests except Calais. See Longman, 'Life and Times of Edward III.' (1869); Mackinnon, 'History of Edward III.' (1900).

**Edward IV.**, king of England: b. Rouen, France, 29 April 1441; d. 9 April 1483. His father, Richard, Duke of York, was grandson of Edward, Earl of Cambridge, and Duke of York, fourth son of Edward III., while the Lancaster branch descended from John of Gaunt, the third son. The York line had intermarried with the female descendants of Lionel, the second son, which gave it the preferable right to the crown. Edward, on the defeat and death of his father at the battle of Wakefield, assumed his title, and having entered London after his victory over the Lancastrians at Mortimer's Cross, in Febru-



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ary 1461 was declared king by acclamation. Soon after his accession he had to fight for his crown against an army of 60,000 Lancastrians, assembled in Yorkshire; and the field of Towton confirmed his title by a decisive victory. Although the high-spirited Margaret was enabled by the aid of Louis XI. of France again to take the field, the result of the battle of Hexham, in May 1464, obliged her to return to Flanders, and leave her husband, the imbecile Henry VI., a prisoner in the hands of his enemies. By a marriage with Elizabeth Woodville, widow of Sir John Grey of Groby, a Lancastrian, Edward plunged himself into very serious difficulties, since at the same time he had despatched the Earl of Warwick to negotiate a marriage for him with Bona, sister to the Queen of France; so that he at once offended two royal houses and his powerful friend Warwick. Aided by France, Warwick, who had contracted his daughter to the Lancastrian Prince Edward, landed with Clarence and some other lords at Dartmouth; and quickly saw himself at the head of 60,000 men, with whom he marched to encounter Edward. The king left Warwick in full possession of his kingdom, 11 days after he had set his foot in it. Henry's title was again recognized by Parliament, and Warwick and Clarence were declared regents of the kingdom. Edward subsequently landed at Ravenspur, in Yorkshire. Here his forces were reinforced by partisans from all quarters, and he was soon enabled to march to London, where he obtained entrance as king, and the unfortunate Henry again became prisoner. Warwick advanced against him as far as Barnet, where, on 4 April 1471, another great battle was fought, which ended in the death of Warwick, and a decisive victory on the part of Edward. On the same day Queen Margaret and her son landed at Weymouth, and marched into Gloucestershire, where she was met by the victorious Edward, who totally defeated her at Tewkesbury. The queen and her son Edward being taken prisoners and brought into the presence of the victor, Edward asked the latter how he dared to invade his dominions. On receiving a spirited answer he basely struck the captive prince on the face with his gauntlet — the signal for immediate massacre by the king's brothers and other nobles attendant. Margaret was thrown into the Tower, where Henry VI. soon after died, but whether by violence or by disease is uncertain. The latter part of his reign was disturbed by his jealousy of his brother Clarence, whom he put to death, it is said, by drowning in a butt of Malmsey wine.

**Edward V.**, king of England: b. Westminster 2 or 3 Nov. 1470; d. London 1483. He was the eldest son of Edward IV., and was in his thirteenth year when he succeeded his father in 1483. He fell into the hands of his uncle, the Duke of Gloucester, the regent who caused the young king and his brother to be sent to the Tower, and, it is said, had them smothered by ruffians. Two bodies, answering their description, being found buried at the foot of the stairs of their apartment, in the reign of Charles II., were taken up by that king's order, and deposited in Westminster Abbey.

**Edward VI.**, king of England: b. Hampton Court, England, 12 Oct. 1537; d. Greenwich 6 July 1553. He was the son of Henry VIII. by

Jane Seymour. At his father's death he was only 10 years of age, and as he did not live to attain majority, the public acts of his reign are to be deemed those of his counselors. His education was entrusted to men of the first character for learning, among whom was Sir John Cheke. He was studious, somewhat retiring, devout, and showed a decided preference for the reformed doctrines, and antipathy to those of the Roman Catholic Church. After his father's death his maternal uncle, the Duke of Somerset, became protector, but his administration raised up such powerful enemies that he was brought to the scaffold with the king's consent (1552). After his death Dudley, Duke of Northumberland, became all-powerful, and through his influence Edward, in a declining state of health, was induced to set aside the succession of both his sisters, and to settle the crown upon Lady Jane Grey, claiming through his father's youngest sister, the Duchess of Suffolk.

**Edward VII.**, king of Great Britain and Ireland, and Emperor of India: b. Buckingham Palace 9 Nov. 1841, and baptized as Albert Edward. He is the eldest son and the second child of the late Queen Victoria and the prince consort, Prince Albert of Saxe-Coburg. On 14 December in the year of his birth he was, as heir-apparent, created Prince of Wales. After receiving a careful education under private tutors he studied at the universities of Edinburgh, Oxford, and Cambridge. In the summer of 1860 he visited Canada, where he was enthusiastically received, and by special invitation of President Buchanan extended his visit to the United States, where his reception was no less cordial. He was appointed a brevet-colonel in the army in 1858, and three years later was attached to the Curragh Camp in Ireland. In October 1861, he was made a bencher of the Middle Temple. In 1862 he was promoted to the rank of general, and in the spring of that year he set out on a visit to Egypt, Palestine, Syria, and Athens in company with the Rev. Arthur Penrhyn Stanley, afterward Dean of Westminster. After the Prince's return from the East he was introduced at the privy council, in 1863 he took his seat in the House of Lords, and about the same time formally gave up his right to succeed to the Duchy of Saxe-Coburg-Gotha. On March 10, 1863, at St. George's Chapel, Windsor Castle, he was married to the Princess Alexandra, eldest daughter of the King of Denmark. From this time onward the Prince discharged many important public ceremonial functions in various parts of the United Kingdom. Near the end of 1871 he was attacked by typhoid fever, and for a time it seemed as if his death were imminent, but he had completely recovered early in 1872. On 27 February of that year his recovery was made the occasion of a special thanksgiving service in St. Paul's Cathedral. In October 1875 he sailed from Dover on his journey to India. He arrived at Bombay in November, and between that date and his departure for England in March 1876 he visited the chief provinces, states, and cities of the Indian Empire, being everywhere received with the utmost cordiality and respect. With the Princess he made an extended tour through Ireland in 1885, and in 1888 his silver wedding was celebrated. The establishment of the Im-



## EDWARD—EDWARDS

perial Institute as a memorial of the jubilee of the late queen (in 1887) was mainly due to his suggestion and exertions. In 1893 he sat on the Poor Law Commission, and in 1896 he was appointed chancellor of the newly created University of Wales. In the diamond jubilee year (1897) he established the Prince of Wales Hospital Fund for the better financial support of the London hospitals. At the great naval review of that year he represented Queen Victoria. By the death of his mother on 22 Jan. 1901, he became King of Great Britain and Ireland, and Emperor of India, and has elected to be known as Edward VII. On 14 February he and Queen Alexandra opened Parliament in state. To him and Queen Alexandra have been born: Albert Victor Christian Edward, Duke of Clarence and Avondale, b. 8 Jan. 1864, d. 14 Jan. 1892; George Frederick Ernest Albert, Duke of Cornwall and York, now heir-apparent, b. 3 June 1865, married 6 July 1893, to the Princess Victoria Mary of Teck; Princess Louise Victoria Alexandra Dagmar, b. 20 Feb. 1867, married 27 July 1889, to the Duke of Fife; Princess Victoria Alexandra Olga Mary, b. 6 July 1868; and Princess Maud Charlotte Mary Victoria, b. 26 Nov. 1869, married 22 July 1896, to Prince Charles, second son of the Crown Prince of Denmark.

Elaborate national and international preparations for the coronation ceremonies in Westminster Abbey were made for 26 June 1902; but on 24 June all festivities and ceremonies were suspended in consequence of a sudden illness requiring an immediate surgical operation. Owing to his fine natural constitution, the king fully recovered, and the coronation in a greatly modified form was accomplished 9 August. See 'The Private Life of King Edward VII.' (1901); 'Life of the King' by "One of His Majesty's Servants" (1901); 'From Cradle to Crown' (1902).

**Edward**, Prince of Wales, surnamed the Black Prince, English prince: b. Woodstock 15 June 1330; d. Westminster 8 June 1376. He was the eldest son of Edward III. and Philippa of Hainault, and at the age of 15 accompanied his father in his invasion of France, and received from him the honor of knighthood. The victory of Crécy, 26 Aug. 1346, which King Edward left principally to the exertions of the force under his son's command, to use that warlike king's language, "showed that he merited his spurs." It was on this occasion that he assumed the motto of *Ich dien* (I serve), used by all succeeding princes of Wales, and derived, it is said, from the crest of the King of Bohemia, slain in that battle, which tradition, however, later antiquaries seem disposed to discredit. In 1355 he commanded the army which invaded France from Gascony, and the next year fought the great battle of Poitiers, and distinguished himself by the courtesy with which he treated his prisoner, King John. By the Peace of Bretigny his father had obtained the provinces of Poitou, Saintonge, Périgord, Limousin, etc., which he annexed to Guienne and formed into a sovereignty for his son, under the title of the Principality of Aquitaine. There the prince took up his residence; and at his court Pedro the Cruel sought refuge, when driven from his throne by his natural brother, Henry of Trastamare. Edward undertook the re-establishment of this

tyrant, which he accomplished. Disappointed, by the perfidy of Pedro, of the stipulated reimbursements, the taxes he was obliged to levy on his new subjects rendered his government unpopular; and an appeal was made to the king of France, as his liege lord, who summoned him as his vassal to appear at Paris. "I will come," replied the angry prince, "but it shall be at the head of 60,000 men." His health, however, was too far declined to enable him to take the field, when the king of France invaded his dominions; and having suffered the mortification of seeing his generals defeated, he withdrew into England, and after lingering some time died in his 46th year, leaving an only son, afterward Richard II. He was buried in Canterbury Cathedral, where portions of his armor are still suspended above his tomb.

**Edward, Thomas**, Scottish naturalist: b. Gosport 1814; d. 27 April 1886. As the apprentice of a shoemaker he spent the early part of his life in Aberdeen, and in 1837 married and settled in Banff. Here he struggled for 40 years in a ceaseless effort to acquire a close knowledge of natural history, while at the same time he supported his wife and 11 children on wages that never exceeded 15 shillings a week. Apart from his laborious work as a shoemaker he collected, described, and exhibited numerous specimens of natural history. A biography of Edward, written by Samuel Smiles (q.v.) appeared in 1876, 'Life of a Scotch Naturalist,' and being thus prominently brought before the public, a pension of £50 a year was conferred upon him by the Queen.

**Edwards, Amelia Blandford**, English Egyptologist and novelist: b. London 1831; d. Weston-super-Mare, Somerset, 15 April 1892. Her novels include: 'My Brother's Wife' (1855); 'Hand and Glove' (1859); 'Half a Million of Money' (1865); 'Lord Brackenbury' (1880); 'Barbara's History,' and 'In the Days of My Youth' (1873). Later she achieved great celebrity through her writings and lectures in Europe and the United States on the antiquities of Egypt; her best-known works in this field are: 'A Thousand Miles Up the Nile' (1877); and 'Pharaohs, Fellahs, and Explorers' (1891). She also translated Maspero's work on 'Egyptian Archaeology,' and was secretary of the Egyptian Exploration Fund.

**Edwards, Bela Bates**, American Congregational clergyman: b. Southampton, Mass., 4 July 1802; d. Athens, Ga., 20 April 1852. He was graduated at Amherst College in 1824, was appointed tutor there in 1826, and was assistant secretary of the American Education Society, 1828-33. He edited the 'American Quarterly Register,' 1828-42; founded the 'American Quarterly Observer' in 1833, and edited it after consolidation with the 'Biblical Repository' in 1835-8; edited the 'Bibliotheca Sacra' (1844-52). In 1837 he became professor of Hebrew at Andover Theological Seminary, and in 1848 professor of biblical literature there, which posts he held till his death.

**Edwards, Mrs. Bennett**, English novelist. She has published 'A Tantalus Cup'; 'In Sheep's Clothing'; 'Pharisees'; 'The Unwritten Law'; 'Saint Monica'; 'His Story and Hers'; 'A Woman in Spectacles.'



EDWARD VII  
KING OF ENGLAND



## EDWARDS

**Edwards, Bryan**, English historian of the West Indies: b. Westbury, Wiltshire, 21 May 1743; d. Southampton 15 July 1800. On the death of his father he was taken under the care of an uncle in Jamaica, who left him a large fortune. After a successful mercantile career he returned to England, and in 1796 took his seat for the borough of Grampound, which he represented until his death. He is remembered for his 'History, Civil and Commercial, of the British Colonies in the West Indies' (1793). A new edition of this work (1801) includes a history of San Domingo. He also published 'Proceedings of the Governor and Assembly of Jamaica in regard to the Maroon Negroes' (1796).

**Edwards, Edward**, English librarian: b. London 1812; d. Niton, Isle of Wight, 10 Feb. 1886. He published 'Memoirs of Libraries' (1859); 'Lives of the Founders of the British Museum' (1870); 'Sir Walter Raleigh' (1885).

**Edwards, George**, English sociologist: b. 1752; d. London 17 Feb. 1823. Possessed of the conviction that he held the precious secret of the relief of man's estate, he wrote some 50 books to disseminate the information, among which is one with the long title: 'The Practical System of Human Economy, or the New Era at Length Fully Ascertained, Whereby We are Able in One Immediate Simple Undertaking to Remove the Distress, Burdens, and Grievances of the Times, and to Bring All our Interests, Public, Private, and Commercial, to their Intended Perfection' (1816).

**Edwards, George Wharton**, American artist and author: b. Fair Haven, Conn., 1859. His works include: 'P'tit Matin and Other Monotones' (1887); 'Thumb-Nail Sketches' (1886); 'The Rivalries of Long and Short Codiac' (1888); 'Break o' Day, and Other Stories' (1889). He is at present art director of 'Collier's Weekly.'

**Edwards, Harry Stillwell**, American journalist and novelist: b. Macon, Ga., 23 April 1854. He was graduated from the law department of Mercer University, and practised law, but in 1871 entered journalism in his native city. He is well-known as a writer of dialect stories. Among his works are: 'Two Runaways, and Other Stories' (1889); 'Sons and Fathers'; 'The Marbeau Cousins'; 'His Defense, and Other Stories.'

**Edwards, Henri Milne-**. See MILNE-EDWARDS.

**Edwards, Henry Sutherland**, English author: b. London 1828. He traveled and studied in Russia, Turkey, and central Europe, acting as newspaper correspondent. He has written 'The Polish Captivity' (1863); 'Life of Rossini' (1869); 'The Germans in France' (1874); 'The Slavonian Provinces of Turkey' (1876); 'The Prima Donna: Her History and Surroundings from the 17th to the 19th Century' (1888); 'Dutiful Daughters' (1890), a tale of London life; 'Personal Recollections' (1900).

**Edwards, John**, American poet: b. near the river Twrch, Wales (whence known as Eos-Glan-Twrch, or "the nightingale of the Twrch"), 15 April 1806; d. near Rome, N. Y., 20 Jan. 1887. He did much to promote the publication in America of Welsh periodicals. His published

poems include 'The Crucifixion' (1853), and 'The Omnipresence of God' (1859).

**Edwards, Jonathan**, American metaphysician, and theologian: b. East Windsor, Conn., 5 Oct. 1703; d. Princeton, N. J., 22 March 1758. His father, a minister of the gospel, instructed him in the dead languages. The son entered Yale College, New Haven, in 1716, and after taking his degree in 1720, remained nearly two years at Yale, preparing for the Congregational ministry. In September 1723 he was elected a tutor in Yale College, and in the following year began to act in that capacity, but resigned in 1726, in order to become minister at Northampton, Mass., where he was ordained 15 Feb. 1727. His various sermons and disquisitions procured for him a wide reputation. His 'Treatise on Religious Affections' was immediately republished in England and Scotland, and placed him among the first writers of his sect. After more than 23 years of zealous service in Northampton, a rupture occurred between him and his congregation owing to the candor with which he publicly reprovved certain irregularities of some young persons connected with families in his church. An ecclesiastical council dismissed him in June, 1750; and in the following year he accepted a call to serve as a missionary among the Indians at Stockbridge, Mass. Here he remained six years, exerting himself with an apostolical spirit, and at the same time prosecuting the deepest investigations in mental philosophy. Here he composed his famous works on the 'Freedom of the Will,' and on 'Original Sin.' The first is his masterpiece, and worthy of the powers of a Locke, or Leibnitz. It was completed within the space of four months and a half. The date of its first appearance is the early part of 1754. In 1757 he was chosen president of the college at Princeton, N. J., and accepted this invitation, though not without reluctance, on account chiefly of his desire to accomplish two great literary enterprises which he had begun long before—a 'History of the Work of Redemption,' and a 'View of the Harmony of the Old and New Testaments.' In January 1758 he went to Princeton, where he died two months later. See 'Life' by Dwight (1830); Allen, 'Jonathan Edwards' (1889).

**Edwards, Jonathan (the younger)**, American theologian: b. Northampton, Mass., 26 May 1745; d. Schenectady, N. Y., 1 Aug. 1801. At the age of six years he went with the family of his parents to Stockbridge, where there was but one school, and that common to the children of both the Indians and white inhabitants, of the latter of whom there were so few that he was in danger of forgetting the English tongue. He so thoroughly learned the language of the Stockbridge Indians, that, as he tells us, all his thoughts ran in their dialect. This knowledge of their language he retained through life. In 1761 he entered the college at Princeton, N. J., where he was graduated in 1765. After leaving college he studied divinity, and in 1776 was licensed as a preacher of the gospel. In 1769 he was ordained as pastor of the church in White Haven, in the town of New Haven, Conn., where he continued till May 1795. Resigning this charge, mainly on account of difference in doctrinal views between himself and some of his

people, he was settled in 1796 as pastor of the church in Colebrook 1796-9, where, in addition to professional duties, his time was devoted to his favorite studies, and to an extensive correspondence which he had long carried on with learned men both in this country and in Europe. In May 1799 he became president of Union College, Schenectady, which office he filled at the time of his death. He was the author of a treatise on 'Liberty and Necessity' (1797); and 'Discourses on the Atonement' (1785). See life by Tryon Edwards.

**Edwards, Julian**, American composer: b. Manchester, England, 17 Dec. 1855. His opera, 'Victorian,' its libretto adapted from Longfellow's 'Spanish Student,' was produced in London in 1884. Since coming to New York in 1888 he has composed the operas: 'Jupiter' (1892); 'Friend Fritz' (1893); 'King René's Daughter' (1893); 'Madeline' (1894); 'Brian Boru' (1896); 'The Wedding Day' (1897), and various other music.

**Edwards, Justin, D.D.**, American Congregational clergyman: b. Westhampton, Mass., 25 April 1787; d. Virginia Springs 23 July 1853. He was graduated at Williams College in 1810, settled in the ministry at Andover in 1812, removed thence to the Salem Street Church, Boston, in 1828, and in 1829 resigned this charge to become secretary of the American Temperance Society, in the service of which he was engaged for seven years, presenting its cause with great ability and success, by lectures and addresses. After this, he was for six years president of the Andover Theological Seminary. He was the author of several tracts on moral and religious subjects, some of which had a wide circulation. Of his 'Temperance Manual,' some 200,000, and of the different parts of his 'Sabbath Manual,' nearly 2,000,000 copies have been published.

**Edwards, Matilda Barbara Betham-**. See BETHAM-EDWARDS, MATILDA.

**Edwards, Oliver**, American soldier: b. Springfield, Mass., 30 Jan. 1835. He entered the Union army at the beginning of the Civil War, and rose, gaining almost every step by acts of personal gallantry, to the rank of brigadier-general in 1865. After the War he engaged in mercantile pursuits.

**Edwards, Osman**, English lecturer and dramatic critic: b. Liverpool 18 Feb. 1864. He has published 'Short Studies of Theatrical Life' from the French of Daudet (1892); 'A Gauntlet' from the Norwegian of Björnson (1894); 'Residential Rhymes' (1899); 'Japanese Plays and Playfellows' (1901).

**Edwards, Pierrepont**, American lawyer, son of Jonathan Edwards (q.v.): b. 1750; d. 1826. He was graduated at Princeton in 1768, and admitted to the bar in 1771. He served in the Revolutionary Army, became a member of the Continental Congress and subsequently was appointed a district judge in Connecticut. As founder of the Toleration Party he was very unpopular in New Haven.

**Edwards, Richard**, English dramatist: b. Somersetshire 1523; d. 31 Oct. 1566. He was educated at Oxford, where he obtained distinction for scholarship, and became under Elizabeth one of the gentlemen of the queen's chapel,

and had charge with others of the theatrical representations before the children there. His 'Damon and Pythias' was the first English tragedy on a classical subject, and was acted before the queen at Oxford in 1566. Though esteemed among the best writers of interludes and rude comedies of the time, all his other dramas are lost. He wrote several minor poems, one of which, entitled 'Amantium Ira,' has been often reprinted in modern collections.

**Edwards, William**, American inventor: b. Elizabeth, N. J., 11 Nov. 1770; d. Brooklyn, N. Y., 1 Dec. 1851. After receiving a common school education he learned the tanning trade, and built his own tannery at Northampton, Mass., but eventually settled in Hunter, Greene County, N. Y. Here he opened a model tannery, with improvements in manufacturing appliances originated by himself. His principal invention was a leather-rolling machine, which saved the labor of hammering. He invented other machines, and utilized water power to such an extent as practically to revolutionize the tanning business in the United States, improve the quality of shoe-leather and cheapen its cost.

**Edwards, William Henry**, American naturalist: b. Hunter, Greene County, N. Y., 15 March 1822. He was graduated at Williams College 1842, and was admitted to the bar 1847. In 1846 he traveled in South America, going up the Amazon River and making a natural history collection. He has published: 'Voyage up the Amazon' (1847); 'The Butterflies of North America' (1879, 1884 and 1897); 'Shaksper, not Shakespeare' (1900); and contributed over 150 papers on Lepidoptera to the 'Canadian Entomologist.'

**Edwardsville**, Ill., city, county-seat of Madison County; on the Illinois Terminal, the T. St. L. & K. C., and the Wabash R.R.'s, about 70 miles southwest of Springfield, and 20 miles northeast of St. Louis, Mo. It is the centre of a coal mining and agricultural region. The industries are such as are adapted to the country, including several plants for the manufacture of tools and other hardware. Pop. 4,212.

**Edwin**, king of Northumbria: b. about 585; d. 633. He was the son of Ella, who seems to have ruled that kingdom from 559 to 589. Being an infant at his father's death the crown was seized by Ethelfrith of Bernicia. The young prince was sent for protection to the court of Redwald, king of East Anglia, by whose aid he was eventually put upon the throne (617). He married Ethelburga, daughter of Ethelbert of Kent, and by her influence and that of Paulinus, a Roman missionary, whom she had brought from her father's court, was led to embrace Christianity, and make it the religion of his people. He was baptized in 627 at York, where he built the first church of wood. The Mercians, under Penda, revolted against the supremacy claimed by the Northumbrians; and the war which ensued was closed by a battle at Heathfield, or Hatfield, in Yorkshire, in which Edwin was defeated and slain.

**Edwin Drood**. See MYSTERY OF EDWIN DROOD.

**Edwy**, king of England: b. about 938; d. 958. He was son of Edmund I., and succeeded his uncle Edred in 955. Taking part with the

secular clergy against the monks, he incurred the confirmed enmity of the latter. Having called Dunstan to account for his share in the administration in the preceding reign, the latter refused to attend the summons, and was in consequence banished. His party was, however, so strong that a rebellion was excited, and Edwy driven from the throne, to make way for his brother Edgar.

**Beckhout**, ěk'howt, or **Eckhout**, **Gerbrand van den**, Dutch painter: b. Amsterdam 19 Aug 1621; d. there 22 July 1674. He was one of the pupils of Rembrandt, and in some measure successful in imitating his manner, especially in the early part of his life. He excelled chiefly in painting portraits, and these as well as his historical pictures abound in the best collections of Holland, while several of them are to be found in Germany. His most esteemed work represents Christ among the doctors.

**Eecloo**, ā-klō', Belgium, town in province of East Flanders, 11 miles northwest from Ghent, near the Liève. The manufactures are chiefly woolens, cottons, hats, tobacco, chocolate, soap, and starch; and it has breweries, distilleries, salt-refineries, dye-works, and oil-mills; and an active trade in grain, linen, cattle, and timber. Pop. 13,200.

**Eekhoud**, ěk'howt, **Georges**, Belgian novelist and poet: b. Antwerp 27 May 1854. He first published two volumes of poetry, 'Myrtles and Cyresses' (1876); and 'Poetic Zig-Zags' (1877); then became a newspaper literary critic in Brussels, and wrote several short stories. His first considerable novel, 'The Militia of St. Francis' (1886), is a masterly portrayal of Flemish peasant life, especially its naïve mystic religiousness. His masterpiece, 'New Carthage' (1888), paints Antwerp life in its naked actuality. Still other works of his are: 'The Fusillades at Mechlin' (1890), a story of the peasants' uprising against the French in 1798; and 'La fanéuse d'amour' (1900). In poetry he has developed from romanticism to pronounced realism.

**Eel**, the general name given to a variety of teleostomous fishes of diverse structure and resembling one another chiefly in their elongated form, soft rayed fins, and the tendency for the paired fins to become reduced in size. Although their seclusive habits render the eel-like fishes liable to be overlooked, and it is evident that many remain undiscovered, the number and diversity of those already known are very considerable. Ichthyologists have arranged them in numerous families and several orders, which Prof. Cope regarded as forming a series degenerate in respect to the gradual loss of the paired fins, and certain ossifications of the skull, and in the simplification of the gill arches. According to the classification of Jordan and Evermann, most of the eels fall within the order Apodes, the others chiefly within the *Plectospondyli*, *Symbranchia*, and *Carenchelyi*. The common eel or fresh-water eel (*Anguilla chrysa*, but also described under a number of other names) belongs to the first order and the family Anguillidae. It is doubtfully distinct from the European fresh-water eel (*Anguilla anguilla*). Both species are characterized—in addition to the serpent-like elongated body, the absence of ventral fins, and the continuity of the dorsal and anal fins round the

extremity of the tail—by the wide interval between the dorsal fin and the head, the projecting lower jaw, well developed pectoral fins, well ossified jaws and gill covers and nearly perfect gill arches. Contrary to the common belief eels are not scaleless but numerous small scales are embedded in the skin. The life history of the eel is very remarkable and in some respects unique. During the spring and early summer multitudes of young eels several inches long migrate up the rivers from the sea and distribute themselves throughout every accessible body of water, whatever its size or character, frequently traveling overland to reach these. Here they remain concealed in the mud or beneath stones and feed on all kinds of animal matter, living and dead, in the pursuit of which they are relentless. Many eels appear never to leave the fresh waters in which they have developed, but most of them after several years return to the sea and enter comparatively deep waters, where sexual maturity and spawning takes place. From the egg a peculiar, compressed, transparent, pelagic larva (*Leptocephalus brevirostris*) is produced, which in due time generally metamorphoses into the young eel which in turn leaves the sea. Some individuals, however, appear to remain permanently in salt as others do in fresh water.

Both in America and in Europe eels are an important and very excellent food fish, and great quantities are caught in a variety of ways. In the United States use is made of hand and set lines, eel spears, eel pots, and weirs. The last is the most efficacious method, but owing to its serious destructiveness of shad and other fishes its use is frequently prohibited by law. A V-shaped fence or net is arranged across the stream with a basket placed in a small opening at the apex, into which the eels are guided by the leads and from which they are unable to extricate themselves. In England river eels are caught in great numbers by means of eelbucks, or eel-pots, traps consisting of a kind of basket with a funnel-shaped entrance composed of willow rods converging toward a point, so that the eels can easily force their way in but cannot return. A stocking or tube of coarse cloth hanging from an aperture of a box down into the interior is also used. A kind of trident, called an eel-spear, is used also for taking them. A fisherman wades to the shallows, and, striking his spear in the mud in every direction around him, the eels reposing on the bottom are caught between the prongs. Except a few other species of the same genus as the common eel all eels are strictly marine and are especially numerous in tropical seas where, in the interstices of coral reefs, as also in the deep sea, some very remarkable kinds occur. For an account of the species consult Jordan and Davis, Report U. S. Fish Commission for 1888; Jordan and Evermann, Bulletin U. S. National Museum, No. 47, Pt. I.; and Goode and Bean, 'Oceanic Ichthyology.' See also articles: CONGER EEL; ELECTRIC EEL; SNIPE EEL; MORAY; PELICAN FISH; SNAKE EEL, etc.

**Eel-grass**, or **Grass-wrack**, a common name for a marine grass, *Zostera marina*, of the pondweed family (*Naiadaceae*). The leaves are narrow and ribbon-like, blunt at the end, sometimes six feet in length. The flowers are crowded in a spadix. It is found in bays or



streams along the Atlantic coast from Greenland to Florida, and on the Pacific from Alaska to California, also on the shores of Europe and Asia. The genus *Zostera* (from the Greek, referring to the ribbon-like leaves), comprises six genera, of which two besides the eel-grass are found in America. They are all marine plants, and are found on the coasts in the north temperate zone.

**Eel-pout**, the name of various fishes. It is applied in the United States to the burbot or ling of the Great Lakes and to the mutton-fish; in Great Britain to the burbot (q.v.), and in northern Africa to the electric catfish (*Malapterurus*).

**Eells, Myron**, American Congregational clergyman: b. Walker's Prairie, Wash., 7 Oct. 1843. He was graduated at Pacific University, Ore., 1866, and at Hartford Theological Seminary 1871. He was pastor at Boise City, Idaho, 1872-74, later serving as missionary to the Indians at Skohomish, Wash., where he filled the pulpit of the Congregational Church 1876. Among his works are: 'History of Congregational Association of Washington and Oregon' (1881); 'History of the Indian Missions on the Pacific Coast' (1882); 'Ten years at Skohomish' (1886); 'Father Eells' (1894).

**Eelworm, or Vinegar Eel** (*Anguillula aceti*), a small *Nematoda* (q.v.) worm of the family *Anguillulidae*, often found in immense numbers in good cider vinegar or in sour paste, where it feeds on the mucilage and organic fluids. It is just visible to the naked eye and wriggles very actively. Like many related species it is very resistant to dessication and other influences ordinarily destructive to animal life. A vast number of similar species live in the earth and feed on decaying organic matter, others are parasitic on plants, in which they are at least the partial causes of certain very serious diseases; thus *Tylenchus devastatrix* causes the "clover disease" and *Heterodera schachtii* the still more destructive "beet sickness," which sometimes devastates the sugar beet crop of Germany.

**Effen'di**, a title of respect among the Turks, bestowed on civil officials, and on educated persons generally, in contradistinction to the military title of *aga*. It is nearly equivalent to the French *Monsieur*, but is suffixed to the personal name.

**Effigy**, formerly **Effigie**, (1) a copy or imitation of an object, an image or likeness; in sculpture frequently applied to the figures on sepulchral monuments; (2) to execute or degrade, as the execution or degradation of a condemned criminal, when he cannot be personally apprehended, by subjecting his image to the formalities of an execution; for instance, affixing the image with a rope round the neck to the gallows (hanging in effigy). This practice is not altogether extinct in Prussia, and in other countries; but in England it has become merely a mode in which the populace expresses its feelings respecting an obnoxious personage; such as the English custom of parading and burning the effigy of Guy Fawkes on 5 Nov.

**Effingham, Ill.**, city, county-seat of Effingham County; on a branch of the Wabash River, about 240 miles south by west of Chicago, and on the Illinois C., the Wabash, and Vandalia

R.R.'s. The city is the trading point of an agricultural region, and has some small manufacturing. It contains Austin College and a large photographic school. Pop. 3,825.

**Efflores'cence**, a term applied to crystals, which, on exposure to the air, lose water of crystallization and crumble down into a powder. The most familiar instance is that presented by the glassy crystals of washing soda, which become white and pulverulent in the air. The same phenomenon is also presented by phosphate of sodium, borax, and other compounds. Another application of the word is to the fine white, feathery crystallization of sulphate and carbonate of sodium which appears on walls, or similar crystallizations on the surface of the earth, in decomposing rocks, etc. Efflorescence is in some respects the opposite of deliquescence, and the difference is shown by placing an efflorescent and deliquescent body under a bell-jar. The former gives up its water, which the latter absorbs, becoming thereby fluid. See **CRYSTALS**.

**Effu'sion** (Lat. "to pour out"), in physics and chemistry, the escape of a gas into a vacuum, through a small opening (such as a pin-hole) in a thin partition. So long as the temperature of the gas is constant, the velocity of effusion is independent of the pressure. For the same gas at two different temperatures (but at the same density), the velocity of effusion varies directly as the square root of the absolute temperature. The velocities of effusion of two different gases (both at the same constant temperature) are inversely proportional to the square roots of the densities of the gases; the densities being determined by comparison under convenient but identical conditions of temperature and pressure.

**Eft**, a name given to several species of newts, especially to the common smooth newt (*Lissotriton punctatus*). The eft has a slightly free tongue, double longitudinal series of palatal teeth, and nailless toes, four before and five behind. The skin is smooth; the dorsal and caudal crests are continuous; there are two patches of glandular pores on the head, and none on the back or sides. The color in the male is brownish gray above, passing into yellowish beneath, which in the spring becomes bright orange; there are numerous round dark spots of unequal size, and two longitudinal streaks on the head; the crest in spring is often tipped with red or violet. The female is light yellowish brown, or buff with brown dots, plainer below. The total length is about  $3\frac{1}{2}$  inches, of which the tail is nearly one half. It is very common in the ditches and ponds of Europe, especially where the water is clear. Its food consists principally of aquatic insects, larvæ, worms, and mollusks. The reproduction and metamorphosis are almost identical with those of the newts. Though usually spending most of their time in the water, the young in June, and the adults in summer and autumn, become terrestrial; they appear to attain their full size the first year. Their bite is perfectly harmless. They are eaten by the larger amphibians, by fishes, and by various reptiles, birds, and small mammals.

**E'gan, Maurice Francis**, American author: b. Philadelphia 24 May 1852. He was graduated at La Salle College; and was subsequently

professor of English literature in the University of Notre Dame, Ind., and professor of English language and literature in the Catholic University of America in Washington, D. C. His publications include: 'That Girl of Mine' (1879); 'Preludes' (1880), a book of poems; 'Songs and Sonnets' (1885); 'The Theater and Christian Parents' (1885); 'Stories of Duty' (1885); 'A Garden of Roses' (1886); 'The Life Around Us' (1886); 'Studies in Literature'; 'The Watson Girls'; etc.

**Egan, Patrick**, American politician: b. County Longford, Ireland, 1841. He became identified with the Nationalists and the Home Rule Movement in 1871, and was one of the organizers of the Irish Land League. He was tried in Dublin in 1880 for conspiracy and sedition, going to Paris upon his acquittal. He came to the United States in 1883, and was president of the Irish National Land League of America 1884-86. He testified before the Parliamentary Commission 1889, and was instrumental in securing the failure of the case of the London *Times* against Parnell. He was appointed minister plenipotentiary to Chile as a reward for his speeches in the campaign of 1888. In Chile he espoused the cause of Balmaceda, the Liberal Dictator. Later he left the Republican party, becoming what was termed a Free Silver Democrat, and taking part in the subsequent campaigns in favor of that issue.

**Egan, Pierce (the Elder)**, English sporting writer: b. London 1772; d. there 3 Aug. 1849. A prolific "historian of the ring" and kindred institutions, he wrote 'Boxiana' (1818); and the widely popular 'Life in London' (1821); which was illustrated by Cruikshank.

**Egan, Pierce (the Younger)**, English novelist: b. London 1814; d. there 6 July 1880. He was a son of the preceding. At first an artist, he turned to fiction, winning fame with 'Robin Hood' (1840); 'Wat Tyler' (1841), and similarly conceived romances; while his later and more sensational tales, 'Imogen'; 'Fair Lillias'; and others, appeared for the most part as serials only.

**Egaña, Juan**, hoo-än' ā-gä'ña, Chilean author and statesman: b. Lima 1769; d. Santiago, Chile, 13 April 1836. He took an active part in the revolution, was a member of the first Chilean Congress, was captured and imprisoned on Juan Fernandez Island, but was liberated in 1817, and was again a member of Congress until elected president of the Republic in 1823. He was a voluminous writer, both of poetry and prose, his works including several educational text-books. He exercised great influence in shaping the character of the people and the policy of Chile.

**Egbert**, king of Wessex: b. about 775; d. 837. On the death of Alcmund, the former king, Brihtric, a powerful noble, succeeded in ousting Egbert, who had the best claim to the throne, and was compelled to take refuge first in the court of Offa of Mercia, then in that of Charlemagne. On the death of Brihtric he succeeded him as king of Wessex, in 800. He reduced the other kingdoms, and rendered them dependent on him, in 827, and is thus considered the first king of all England.

**Egbert, Harry C.**, American military officer: b. Pennsylvania 3 Jan. 1839; d. 4 March 1899. He entered the army as first lieutenant in September 1861; was promoted captain in 1865; major in 1890; and colonel on 1 July 1898. In October of the latter year he was commissioner brigadier-general of volunteers. When the war with Spain broke out he commanded the 6th Infantry, of which he was lieutenant-colonel. In the Santiago campaign, while leading a charge at El Caney, 1 July 1898, he was shot through the body. He had scarcely recovered from his wound when he applied for service in the Philippines. He arrived at Manila with his regiment 4 March 1899, and was killed while storming Malinta, on the 26th.

**Egbert, James Chidester**, Roman archæologist and epigraphist: b. New York 1859. He was graduated at Columbia University in 1881, and held a prize fellowship (1882-85). He began to teach in the University in 1885 and was adjunct professor of Latin 1885-90. In 1890 he was appointed professor of Roman archæology and epigraphy in Columbia, and while he has done much to promote the study of these special subjects, and has published: 'Introduction to the Study of Latin Inscriptions,' he has also edited 'Cicero de Senectute'; and written 'Macmillan's Shorter Latin Course.'

**Egede, Hans**, hänts ā'gē-dē, Danish missionary, termed the apostle of Greenland: b. Harstad, Norway, 1686; d. Falster, Denmark, 1758. In 1707 he became a preacher at Wogen. Having heard that Christianity had been once established in Greenland, but had become extinct in the country for want of teachers, he resolved to visit the country, and to preach the gospel to the inhabitants. Having received from the Danish government the title of royal missionary to Greenland, with a small pension and three ships, he sailed on 21 May 1721 with 46 persons under his command. Egede landed on 4 June, and the conversion of the Greenlanders was now undertaken, but offered great difficulties. Egede took up his residence, with his two sons, among the natives, in order to learn their language, and so be able to carry out his project of conversion. He carefully noted down every word of which he discovered the meaning; often performed long journeys, at the peril of his life, to visit the remotest Greenlanders, for the purpose of gaining their confidence, in which he succeeded by a thousand acts of kindness. After spending fifteen years in Greenland, amid innumerable discouragements, he returned in 1736 to Copenhagen, to make new exertions for the support of Christianity in that country. The government appointed him director of the Greenland missions, and established his son Paul in the office of missionary there. His writings are in Danish, and relate to the natural history of Greenland, and his sufferings and adventures there.

**Egede, Paul**, Danish missionary: b. 1708; d. Copenhagen 1789. He was a son of Hans Egede and was his assistant from the time he was 12 years old. Notwithstanding a strong inclination for the naval service, he submitted to the wishes of his father, studied divinity, joined the mission in Greenland in 1734, and remained there till 1740. He then returned to Copenhagen, and afterwards was appointed

Bishop of Greenland. We have from him an 'Account of Greenland,' extracted from a journal kept from 1721-88; 'Dictionarium Grœnlandicum'; 'Grammatica Grœnlandica'; and translation of the Gospels, the 'Imitation of Christ,' etc., in the Greenland tongue.

**Egelhaaf**, ä'gël-häf, **Gottlob**, German historian: b. Gerabronn, Württemberg, 1 March 1848. He has published: 'A History of Germany During the Reformation' (3d ed. 1893); 'Emperor William' (3d ed. 1888); 'A History of Germany During the Sixteenth Century until the Peace of Augsburg' (1888-92); and other works.

**Eger**, ä'gër, Bohemia, town in the northwest, on a rocky eminence above the Eger, 91 miles west of Prague. It was once an important fortress, founded in the 12th century. Six lines of railroads converge at Eger. There are various industries, including machinery, wool, cotton, and leather manufactures, and a flourishing trade. The celebrated Wallenstein was assassinated here (1634). Franzensbad, a watering place, is connected with Eger by an avenue three miles long. Pop., of the commune, 24,200.

**Eger**, a river which rises in Bavaria, in the Fichtelgebirge, 12 miles northwest of the town of Eger, flows first southeast, then takes a northeasterly direction into the Elbe, near Leitmeritz, in Bohemia, after a course of about 190 miles.

**Egeria**, ê-jë'rî-ä, (1) a nymph who received divine honors among the Romans. Numa is said to have had secret conversations with her, and to have received from her the laws which he gave to the Romans. Some say Egeria was the wife of Numa. (2) a genus of spider crabs of the family *Maidea*; (3) a genus of bivalve shells of the family *Donacidae*; (4) in astronomy, the thirteenth planetoid, discovered by De Gasparis, at Naples (1850).

**Egerton**, ëj'ër-tôn, **George** (pseudonym of Mrs. MARY CHAVELITA DUNNE MELVILLE CLAIRMONTE BRIGHT), English novelist: b. Australia 14 Dec. 1860. She was married in 1888 to H. Melville, who died in 1889; in 1891 to Egerton Clairmonte, who died in 1901; and in 1901 to R. G. Bright. She has traveled extensively, visiting the United States four times. She has published: 'Key-notes' (1893); 'Discords' (1894); 'Young Ofeg's Ditties' (1895); 'Symphonies' (1897); 'Fantasias' (1898); 'The Wheel of God' (1898); 'Rosa Amorosa' (1901); 'The Hazard of the Ill' (1902).

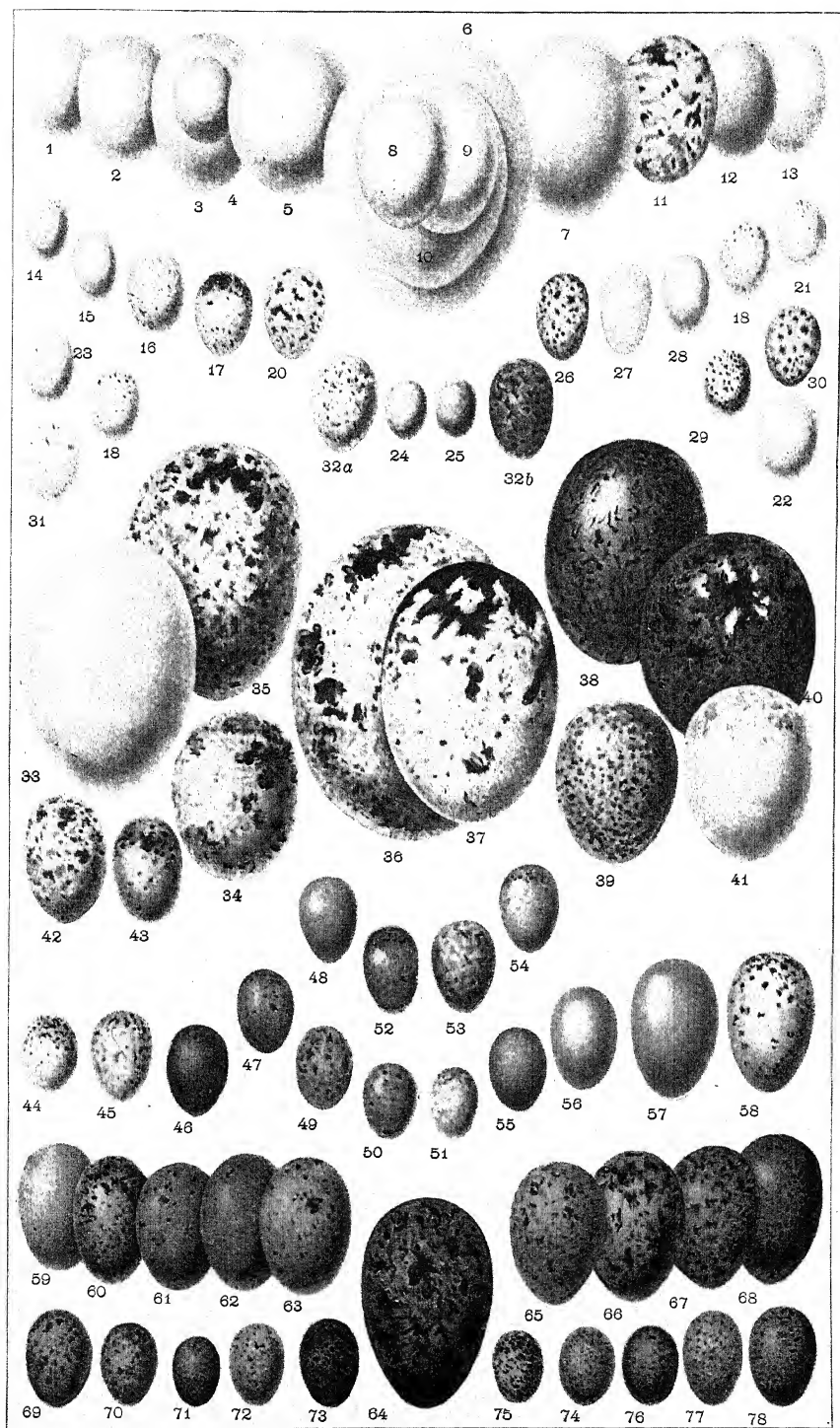
**Egg**, **Augustus Leopold**, English painter: b. London 2 May 1816; d. Algiers, Algeria, 26 March 1863. He became a contributor to the Academy exhibition in 1838, and was elected a member of the Royal Academy in 1860. He painted a great number of pictures illustrative of humorous scenes from Shakespeare, Le Sage, and Walter Scott.

**Egg**. A cell (ovum) developed in the female reproductive organ (ovary) of any metazoic animal, which, when joined with a male cell (spermatozoön) develops under suitable conditions into an organism like the parents. For the structure of the egg, which differs from other cells only in its germinative property, see CELL; and for its processes of development, see EMBRYOLOGY.

Animals in which the egg passes out of the body before it is hatched, that is, before the maturity and escape of the embryo, are said to "lay eggs," or to be "oviparous"; those in which the egg remains inside the body to hatch are called "ovoviviparous"; those whose eggs are retained in connection with the parent by means of a placenta and an umbilical cord, so that the young are brought forth alive are called "viviparous." These distinctions, and especially the first two, are of secondary importance, and in some cases it is difficult to classify an animal according to them; or varying conditions may lead to change in the same species or individual at different times. A few lowly mammals (the *Monotremes*, q.v.), all birds, and most other animals, "lay" their eggs. The ovoviviparous ones are to be found chiefly among reptiles and fishes.

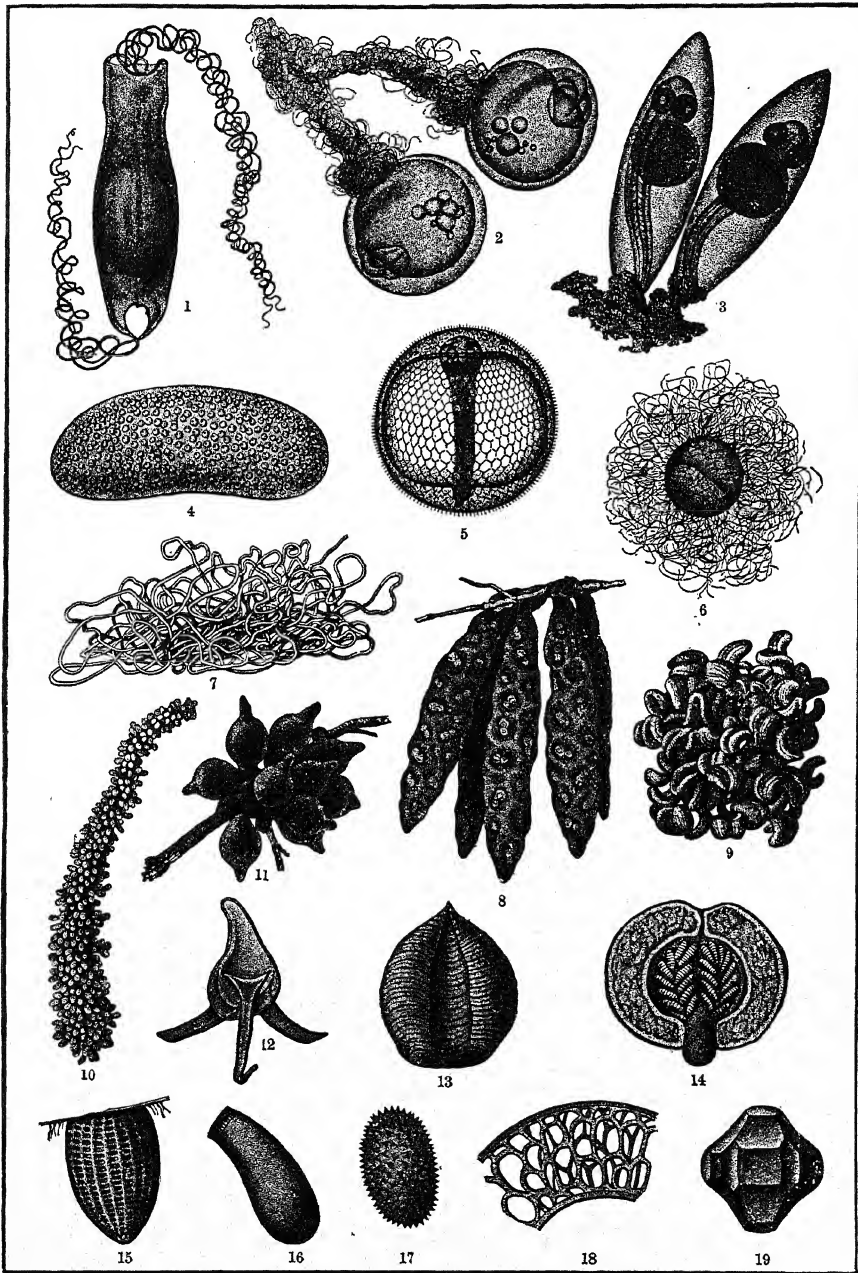
As in all the higher animals the development of the egg is prolonged, and the young animal must reach a comparatively perfect state of development before it leaves the egg; provision for its nutrition during embryonic development must be made by the storage of food in the egg to be gradually absorbed by the growing embryo; also room for growth, and therefore such eggs are always relatively large. The food is primarily the yolk, which is distinctly yellow in the eggs of birds, reptiles and amphibians, and consists of granules of albuminous and fatty matter perfectly adapted to the nutrition of the young. It lies in concentric layers about the whitish germinal vesicle or "tread" of the egg, which is the protoplasmic part where alone development proceeds. This vesicle floats on the surface of the food-yolk, and remains on top, by reason of its lightness, no matter how the egg is turned. The eggs of many of the lower animals contain food-yolk, but it is usually colorless. The egg of a hen or other bird is further furnished with layers of albumen (the "white") placed upon it in the narrow upper part of the oviduct. Outside of this there is next deposited upon the albumen a fibrous membrane of double thickness (the "egg-pod"), the splitting of which later forms the "air-chamber" at that end of the egg where the head of the chick lies. In a further stage of descent along the oviduct there is deposited in and upon the egg-pod an external covering, or "shell," which may be gelatinous as in the amphibians, or chitinous as among insects, or parchment-like as in reptiles, or calcareous in various degrees, as is familiar in birds' eggs. This shell is porous, so as to admit air to the embryo, which also exposes it to bacteria, so that eggs are liable to quick decay as soon as living influences cease to operate upon it; and preservative methods are directed toward excluding air and germs by closing the pores of the shell. The evil odor of decayed eggs is due to the liberation of sulphuretted hydrogen and certain sulphur proteids, sulphur having a large part in the composition and color of food-yolk. The shells of eggs are often oddly and elegantly shaped, differ greatly in texture and ornamentation, those of insects especially being often exquisitely chased, or studded with projections, and are otherwise beautiful objects under the microscope. Kirby and Spence describe in detail an extraordinary variety, including many which have hinged lids so that the embryo may escape when ready without breaking its way out (see EGG-ROOTER), as do birds and reptiles. The eggs of a great variety

# EGGS.





# EGGS OF FISHES AND LOWER ANIMALS.



1. Egg of Shark.

2. Egg of Cristiceps.

3. Egg, with embryo of Goby.

4. Spawn of parasitic Fierasfer.

5. Egg with embryo of Stargazer.

6. Egg of Garfish.

7. Spawn of a nudibranch.

8. Spawn of Squid.

9. Spawn of Sea-snail.

10. Spawn of Octopus.

11. Egg of Cuttlefish.

12. Egg of a flat-worm.

13. Egg-capsule of Mantis.

14. The same in cross-section.

15. Egg of a butterfly.

16. Egg of Bedbug.

17. Egg of Beetle-mite.

18. Structure of eggshell of a phyl-  
lopod crustacean.

19. Egg of branchiopod crustacean.





## EGG

of birds are further ornamented by a uniform tinting or by spottings in diverse patterns and colors, which consist of peculiar pigments, derived from the blood and laid on at the time of the formation of the shell. These color-markings are characteristic of groups to a great extent, and are mainly combinations of yellow, red-brown and greenish-blue. Vast and valuable collections of the nests and eggs of birds exist in museums; and form the topic of the special science oölogy.

Considering the vast variety of animals, and the world-wide diversity of circumstances under which eggs are laid and of conditions which must be met, the greatest dissimilitude is to be expected. In size their range varies from the microscopic cells produced by most mammals to the huge egg of *epyornis* (q.v.), with a capacity of  $2\frac{1}{2}$  gallons. The human ovum is among the smallest known, being a minute spherical body from 1-120 of an inch in diameter.

While the eggs of the vertebrates are spherical or nearly so (oblong or oval in various degrees), those of invertebrates often take strange polygonal forms, as is seen among the worms, lower crustaceans, and insects, some of which are illustrated on the accompanying plate. Equally diverse are the methods taken for protection of eggs against harm by weather or enemies, and in proportion as these have proved successful the number laid by each individual is decreased. Many marine animals, such as most worms, echinoderms, coelenterates, bivalve mollusks, and fishes pour out millions of ova, or "spawn," most of which serves only as food for other aquatic animals, probably not a tenth of 1 per cent in many cases ever approaching maturity. Creatures above the rank of the more lowly fishes lay comparatively few eggs—some only one annually. This is also true of certain insects, spiders, crabs, and mollusks, where habits of so hiding or protecting the eggs have been acquired that a large proportion are fertilized and hatched. The methods and adaptations for safety observable among insects are exceedingly varied and effective. Some bury their eggs in the ground, or in dead wood, or living wood, or even in the bodies of dead or living animals; some drop them loose into water, or fasten them to a support under its surface; they hide them in all sorts of crannies, glue them firmly to plants, twigs, rocks, or the skin and hairs of other animals. In the majority of cases this protection must withstand the test of resisting prolonged unfavorable conditions, for most species are preserved from year to year only by the hibernation or estivation of their eggs. Among aquatic animals the encasement of the eggs in a gelatinous envelope, as is so common with frogs, newts, and other amphibians; or a tough capsule, as among the cephalopod and many gasteropod mollusks (for example, *Murex*, *Natica*, *Fusus*) is a common method of protection. These egg-cases are often most curious in form and location.

*Economical Value of Eggs.*—The eggs of birds, especially of fowls, and of some reptiles, as turtles, are commonly used for food. Boiled eggs are less nutritious because the hardened albumen is with difficulty digested. A hen's egg of good size weighs about 1.000 grains, of which the white constitutes 600, the yolk 300, and the shell 100. There are generally 10.7 parts shell, 11.9 parts albumen, 12.8 parts fat, .7 parts salt,

and 63.9 water. According to Leppig, the specific gravity of fresh eggs is not less than 1.06 grams, and loses 0.0017 grams a day when kept in the open air; so if an egg sinks in a salt solution of 1.05 specific gravity, the egg is fresh. Besides their use as a food, hen's eggs are used in the technical arts, the albumen in which they are so rich being serviceable in dyeing, manufacture of leather, and for various other purposes.

To preserve eggs for any length of time, they must be kept from the air. They may be rubbed over with butter, lard, gum-water, etc., set on the small end upon a perforated board, or, which is still better, they are placed in layers, upon the small end, in very dry ashes, in dry salt, etc., enclosed in tubs and boxes, and put in a dry place, protected from severe cold in winter, but at the same time not too warm.

Eggs are of great importance in a commercial point of view. In England vast quantities are brought from the country to the large towns, but not in sufficient numbers for the demand, and they are largely imported from the Continent, chiefly from France, Germany, Russia, Belgium, and Denmark, also from Canada, the United States, Egypt, Morocco, and other countries. The value of eggs imported into the United Kingdom is more than \$25,000,000 annually.

In the United States the egg industry has grown during recent years to vast proportions. Formerly this country relied largely upon importation for its supply of eggs, but now it exports far more of them than it obtains from foreign parts. The increasing use of incubators has led to a large increase in the number of eggs laid by native fowls, which need "no longer waste their time in hatching them, but may devote it to the more profitable labor of producing them." It is said by experts in this branch of American industry that although the number of fowls kept in this country is now relatively smaller than formerly, yet by the adoption of labor- and time-saving machines the lesser number has been able to produce a constantly increasing output of eggs.

The production of poultry and eggs is one of the most profitable industries. A statistician of authority estimates that a hen may realize 400 per cent profit for her owner. In 33 States and Territories the value of eggs exceeds the value of the poultry product. The egg product in the United States amounts to more, when measured by dollars and cents, than the combined gold and silver production. Prices have not fallen with the introduction of the incubator.

The value of the annual output of eggs is now \$145,000,000. In their production Iowa leads the States, its yearly product being 100,000,000 dozen. Ohio comes next with 91,000,000 dozen; Illinois third, 86,000,000 dozen; and Missouri fourth, 85,000,000 dozen. With the exception of Alaska and Hawaii, Montana pays the highest price for eggs, the average price being 20 cents a dozen. They are cheapest in Texas, where the average price in 1902 was 7½ cents a dozen. The average price for the 16,000,000,000 eggs which were marketed in the United States that year was 11.15 cents a dozen.

The railroad men of the country have an excellent opportunity to measure the extent of the egg industry in concrete exhibits. The annual output fills 43,127,272 crates holding 30 dozen each. An ordinary refrigerator car, which has

## EGG—EGGELING

an average length of 42.5 feet, holds 400 crates. It is calculated that a train of these cars sufficient to carry the annual product would be 866 miles long, or long enough to reach from Washington to Chicago, and have several miles to spare. A government expert says: "The majority of the fowls of this country are found in comparatively small numbers on a very large number of farms, where they gather their own subsistence and receive practically no care. The consequence of this is that eggs are produced at little cost. The development of this industry to an extent incredibly larger than it is at the present time is among the easy possibilities."

**Egg, or Eigg, ĕg**, one of the Hebrides Islands, belonging to Inverness-shire, Scotland. It is south of Skye. Its length is a little less than seven miles.

**Egg-bird, or Sooty Tern** (*Sterna fuliginosa*), a member of the gull family (*Laridæ*) famous for its edible eggs and breeding societies or "wide-awake fairs." It is found about warm seas throughout the world and abounds in the West Indies. Ascension Island is one of its most frequent breeding places. Occasionally it wanders as far as New England. The adults have beautiful black and white plumage, but the young are of a light, sooty color. The nests are rough excavations in the sand, in which three eggs are usually deposited. They are much valued and the gathering of them in the spring months forms an important West Indian industry. The name egg-bird is also commonly applied to other marine birds of the gull family, as guillemots, murre, etc., whose eggs are of economic value.

**Egg Dance**, a once popular diversion in England, Scotland, Holland, and some other parts of Europe; now confined chiefly to Spain, among the people of Valencia. A number of eggs were arranged in a prescribed form upon the dancing floor, and among them a blind-folded dancer moved as best he might, to music; the object being to execute an intricate dance without breaking the eggs. The music, like the arrangement of the eggs, was also prescribed.

**Egg-eating Snake**, the *Dasypheltis scabra*, a tree-climbing species of coluber found in Central and South Africa. It is about two feet in length and is unique in its adaptation to the diet from which it derives its name. While the jaws are almost destitute of teeth and capable of great distention, a substitute for the teeth is found in the elongated hypophyses or ventral processes of several of the cervical vertebrae, which project into the interior of the œsophagus as a series of saw-like teeth tipped with very hard cement substance. This mechanism enables the snake to secure the entire contents of an egg as large as a hen's without losing a drop, for it is swallowed entire and only broken by contact with the œsophageal teeth when safely within the throat, when the contents are swallowed and the shell regurgitated.

**Egg-fish**, any of various plectognath "globe-fishes," which swell themselves into the shape of an egg. See PLECTOGNATHI; PUFFER.

**Egg-flip**, a drink made of warmed beer, flavored with a little sugar, spirit, spices, and eggs beaten with it.

**Egg-nog**, a drink consisting of the yolk of eggs, beaten up with sugar, to which milk is added, and also usually some kind of spirits. By using the whites of the eggs an agreeable froth is made.

**Egg-plant, Guinea Squash, or Aubergine** (*Solanum melongena*), a plant of the natural order *Solanaceæ*. Its original home is supposed to be the East Indies, where it has long been cultivated and from whence it has been introduced into all tropical countries and many temperate ones for the sake of its egg-like white, yellow, or purple fruits, which are used as a vegetable. In the United States it is cultivated as far north as Long Island and southern Michigan. In the North the plants must be started under glass, and transplanted to the field or garden after danger of frost has passed. They do best upon rich deep loams well exposed to the sun. Their principal insect enemies are practically the same as those of the potato and are combated similarly. (See INSECTICIDE.) Their fungous diseases are few and rarely devastating. The principal ones are a bacterial disease caused by *Bacillus solanacearum*, for which there seems to be no satisfactory remedy; anthracnose (*Glæosporium melongena*), which appears as pink-spotted sunken areas upon the fruits; leaf-spot (*Phyllosticta hortorum*), which turns the affected leaves brown and produces holes in them; and a mold (*Botrytis fascicularis*), which produces soft spots with gray moldy surfaces upon the fruits. Each of these parasites may appear upon any of the green parts, but the parts mentioned are the usual ones. They may all be controlled by timely applications of any standard fungicide.

**Egg-tooth**, the hard calcareous protuberance at the tip of the beak or snout of a chick or young reptile which is born within an egg having a tough shell, designed to assist the embryo in escaping. It wears a hole through the lining membrane of the egg, and then acts as a file to bore through the outer shell or wedge apart any crack. It is possessed by all birds, and by such reptiles (turtles, lizards, and snakes) as develop in eggs with hard coverings. Soon after the embryo goes free this excrescence falls off; and in this special temporary provision for a special non-recurring exigency, Darwin found an example, in his view, of the results of natural selection.

**Egg-urchin, or Sea-egg**, any of the typical globose sea-urchins, especially those of the genus *Echinus*. Similarly, the flat, bun-shaped echinoderms are called "cake-urchins," the cockle-shaped (spatangoids) "heart-urchins," and so on. See ECHINODERMATA; SEA-URCHIN.

**Egga, ĕg'a**, West Africa, town of Gando, in the Niger Territories, on the Niger. Pottery, iron, gold, and wooden-ware, thick cloth, generally dyed blue, and leather are manufactured, and an active river trade is carried on, especially in ivory. Pop. 12,000.

**Eggar-moth**. See EGGER-MOTH.

**Egg'eling, Julius**, English philologist: b. Hecklingen, Germany, 12 July 1842. After studying at Breslau and Berlin, he went to England in 1867 and on account of his knowledge of Sanskrit was appointed secretary and librarian of the Royal Asiatic Society 1869, becoming professor of Sanskrit at University College 1872 and

filling the same chair at the University of Edinburgh three years later. Among his publications are 'The Catapatha-Brahmana, Translated according to the Text of the Madhyandina School' (1882-5); 'Catalogue of Buddhist Sanskrit Manuscripts in the Possession of the Royal Asiatic Society' (with Cowell 1875); the article, 'Sanskrit Language and Literature,' in the *Encyclopædia Britannica*; 'Catalogue of Sanskrit Manuscripts in the Library of the India Office' (1887-9); and editions of 'Vardhamana's Ganaratnamahodadhi' (1879-80); the 'Katantra' (1874-8); and of the 'Kanva Satapatha Brahmana' (1902).

**Egger-moth**, the name of certain species of moth, of the genus *Lasioampa* or *Gastropacha*, allied to the silkworm moths. Several species are found in European countries.

**Eggleston, Edward**, American novelist and miscellaneous writer: b. Vevay, Ind., 10 Dec. 1837; d. Joshua's Rock, Lake George, N. Y., 3 Sept. 1902. He entered the ministry of the Methodist Church, and was more or less engaged in pastoral work for a number of years, at the same time contributing to various periodicals, for some of which he acted as editor. From 1874 till 1879 he was engaged in the work of an independent church founded by himself (the Church of Christian Endeavor, Brooklyn), but in the latter year his health failed and he resigned his position as pastor. Subsequently he devoted himself entirely to literary work. Among the most important of his works are: 'The Hoosier Schoolmaster' (1871); 'The End of the World' (1872); 'Mystery of Metropolisville' (1873); 'Schoolmaster's Stories for Boys and Girls' (1873); 'The Circuit-Rider' (1874); 'Christ in Literature' (1875, edited); 'Christ in Art' (1875, edited); 'Roxy' (1878); 'The Hoosier School-boy' (1883); 'The Graysons: a Story of Illinois' (1887); 'History of the United States and Its People' (1888); 'Household History of the United States and Its People' (1888); 'The Faith Doctor' (1891); 'Duffels,' a series of short stories (1893); 'The Beginners of a Nation' (1896); and 'The Transit of Civilization' (1900). His work as an historian possessed much merit, in that it was based upon careful investigation and exhibited sound judgment. Yet it is by his early stories of the Middle West that he will always be best known. These stories gave to those who read them at that time a real delight. They were written without the slightest trace of literary art; but their themes were wholly novel, and the unstudied simplicity of their narrator made them so natural and so life-like as at once to charm and surprise all sorts of readers. 'The Hoosier Schoolmaster' may be regarded as the first of a class of stories of which 'David Harum' and 'Eben Holden' are much later examples. The book, in reality, marked a new departure in our national literature; for it owed absolutely nothing to any model, but was a tale told directly from life, and from American life of a primitive kind which had not before made its way into printed books.

**Eggleston, George Cary**, American journalist and author: b. Vevay, Ind., 26 Nov. 1839. He is a brother of E. Eggleston (q.v.). During the Civil War he served in the Confederate army. He has long been connected in an editorial capacity with one or another New York news-

paper, including the *World*, the *Evening Post*, and the *Commercial Advertiser*. Among his many books are: 'A Man of Honor' (1873); 'A Rebel's Recollections' (1874); 'How to Educate Yourself' (1872); 'How to Make a Living' (1875); 'The Wreck of the Red Bird' (1882); 'Red Eagle'; 'Juggernaut' (with Dolores Marbourg) (1891); 'A Carolina Cavalier' (1901).

**Eg'ham**, England, village in the County of Surrey, on the Thames, about 21 miles from London. It contains the Royal Indian Engineering College, the Royal Holloway College for Women, and the Holloway Sanatorium. Runnymede, where King John signed Magna Charta, is in Egham parish. Pop. 10,187.

**Egil Skallagrimsson**, á'gíl skál-lá-grímz'-són, Icelandic bard or skald of the 10th century. He distinguished himself by his warlike exploits and adventures in Norway, Denmark, and England. Having killed in combat the son of Erik Blóðöx, king of Norway, he was doomed to death on being subsequently taken prisoner by that prince in Northumbria, but was allowed to redeem his life by giving a specimen of his powers as an improvisatore. He immediately composed and recited a poem in praise of Erik, known as 'Egil's Ransom,' which procured him his life and liberty. This piece (as well as two others attributed to him) is still extant, and Dr. Percy translated it into English, and printed it in his 'Northern Antiquities.' Egil is said to have been born about 901, and to have died about 980, but little dependence can be placed on many of the statements regarding him in the 'Egil's Saga.'

**Egilsson, Sveinbjörn**, svín'bérn á'gílz'-són, Icelandic critic: b. Gullbringasýsla 24 Feb. 1791; d. Reikiavík 17 Aug. 1852. He investigated the native antiquities, edited a series of Icelandic historical works, and completed a 'Poetic Lexicon of the Ancient Tongue of the North' (1855-60), published posthumously.

**Eginhard**, á'gín-hárd, or **Einhard**, ín'hárd, German historian: b. East Franconia, now the Grand Duchy of Hesse-Darmstadt, about 770; d. Seligenstadt 14 March 840. He was educated in the schools of the abbey of Fulda. When about 25 he entered the service of Charlemagne and thereafter was in all things the confidant of the emperor and one of his principal ministers. One of his great charges was the construction and repair of the public buildings. He was inseparable from the emperor, residing in the palace and accompanying him in all his journeys and expeditions: the only time when they were temporarily separated was when, in 806, the secretary—for such he has always been called—went to Rome to obtain the approval of the Pope of a provision of Charlemagne's testament or will for a division of the empire among his sons after his death. That Eginhard possessed considerable learning appears from his extant writings. During his many years of study at Fulda he acquired all the secular knowledge obtainable in his time, and in the palace of Charlemagne enjoyed the advantage of converse with the celebrated Alcuin. It was on the advice of the secretary that Charlemagne in 813 made his eldest son, Lewis, his partner in the empire; and when Lewis, on his father's death, became sole emperor, he retained Eginhard in all his high offices and appointed him tutor of his son.

Lothair. In 830 he withdrew from the court and retired to his large estates at Mulinheim, where he had erected a splendid basilica and founded various religious institutes, and there passed the remainder of his life. He changed the name of the place to Seligenstadt (City of the Saints, namely, of Saints Marcellinus and Petrus). In this basilica he was entombed, beside his wife, Imma, who died four years before him. According to an old legend Imma was a daughter of Charlemagne, and as time went on the story of their love adventures was added to from the fount of romantic imagination: in fact, Charlemagne had no daughter named Imma, and the lady Imma who was Eginhard's wife was the sister of Bernharius, bishop of Worms. Eginhard's 'Life of Charlemagne' (*Vita Caroli Magni*), written in Latin in a style and on lines imitative of Suetonius' 'Lives of the Cæsars,' is one of the most notable literary monuments of the Middle Ages; it was long used as a manual of school instruction and hence has survived in a multitude of manuscript copies. Another work of his is a history of the Franks, 'Annales Regum Francorum, Pippini, Caroli Magni et Hludowici Imperatoris' (Annals of the Frankish Kings Pippin, Charlemagne, and Lewis the Emperor). There are extant 62 of his 'Letters' (*Epistolæ*), and a narrative of the translation from Rome to Seligenstadt of the relics of Saints Marcellinus and Petrus ('*Historia Translationis Beatorum Christi Martyrum Marcellini et Petri*'). To the narrative he appends a poem on the same subject.

**Eglantine**, ɛgˈlæn-tin or -tīn, the name of the sweet-brier rose (*Rosa rubiginosa*), in the poetry of Chaucer, Spenser, and Shakespeare. The name is common among the English poets; the earlier ones applied it to any wild rose, and Milton seems to confound several different species, among them the honeysuckle, etc. The flower is a native of Europe and Asia, but was easily naturalized in America and, being hardy, it withstood the severe winters, and now grows in profusion in the territory from Nova Scotia to Ontario, south to Tennessee, and east to the shores of Virginia. It is from 4 to 6 feet high, sometimes growing as a long spine-covered wand. The pink or white flowers are a marked feature of the flora of this region, during the months of June and July. A climbing-shrub, native of Asia (*Rosa eglanteria*), with yellow, ill-smelling flowers, is also sometimes called eglantine.

**Eglantine Sponge**, a rose gall. See BEDEGNAR.

**Egleston, Thomas**, American mineralogist: b. New York 9 Dec. 1832; d. there 15 Jan. 1900. He was graduated at Yale College in 1854, and at the School of Mines in Paris in 1860. He returned to the United States in 1861; and soon afterward was appointed director of the mineralogical collection and laboratory of the Smithsonian Institution in Washington. He established the School of Mines as a department of Columbia College, New York; and was professor of mineralogy and metallurgy there 1864-97. He was a United States commissioner to examine the fortifications of the Atlantic coast in 1868; and one of the jurors of the International Exposition at Vienna in 1873. He published: 'The Metallurgy of Gold and Silver in the United States'; 'A Catalogue of Minerals and

Their Synonyms'; 'Life of Major-General Paterson, of the Revolutionary Army'; etc.

**Egli, Johann Jakob**, yō'hān yā'kōb ā'glē, Swiss geographer: b. Uhwiessen-Laufen, canton of Zürich 17 May 1825; d. 1896. He was made professor of geography at the University of Zürich 1883, after teaching in several schools, and did much for the accuracy, precision and uniformity of the nomenclature of geography. Among his earlier works are a thesis on the 'Discovery of the Sources of the Nile'; and a 'Geography of Switzerland.' Later works include 'Nomina Geographica: Versuch einer allgemeinen geographischen Onomatologie'; 'Geschichte der geographischen Namenkunde'; 'Neue Erdkunde'; 'Neue Handelsgeographie'; and 'Der Völkerggeist in den geographischen Namen.'

**Eglington and Winton, Archibald William Montgomerie**, EARL OF, English politician: b. Palermo, Sicily, 29 Sept. 1812; d. St. Andrews, Scotland, 4 Oct. 1861. He was lord-lieutenant of Ireland in 1852, and 1858-9. He was a well-known patron of the turf and field sports, and his name is associated with a splendid reproduction of a mediæval tournament, which he gave at Eglington Castle in 1839.

**Eg'mont, Justus van**, Flemish painter: b. Leyden 1602; d. Antwerp 8 Jan. 1674. He was a pupil of Kaspar Van den Hoeck 1651 and later of Rubens. He established himself at Paris where he became court painter to Louis XIII. and Louis XIV., and was also one of the founders of the Royal Academy of Painting and Sculpture 1648. Among his works are: 'Portrait of Archduke Leopold William'; two 'Portraits of Philip IV. of Spain,' Vienna Museum; 'Maria de Medici,' Schleissheim Gallery; and 'Portrait of Queen Christine.'

**Eg'mont, Lamoral, COUNT**, Dutch statesman: b. La Hamaide, Hainault, 18 Nov. 1522; d. Brussels 5 June 1588. He entered the military service, and gained a high reputation under Charles V.; distinguished himself as general of cavalry under Philip II.; and was made stadtholder of the provinces of Flanders and Artois. His connection with the Prince of Orange and his most distinguished adherents made him an object of suspicion to the Spanish court, and Egmont, with Philip of Montmorency, Count Hoorn, became the victims of hate and fanaticism. The Duke of Alva, sent by Philip II. to the Netherlands in 1567 to reduce the insurgents, had Egmont and Hoorn treacherously seized, and caused them both to be executed at Brussels. Egmont died with heroic firmness. He had before written to Philip II., that "he had never joined in any undertaking against the Catholic religion, nor violated his duties as a loyal subject." But the Prince of Orange having taken the field as the champion of his country's wrongs, an example was thought necessary to strike terror into the insurgents. There can be little doubt that the Spanish king unnecessarily dreaded the influence of the gallant soldier but incapable politician. When the troubles in the Netherlands broke out, Egmont, moved by generous sympathy for his injured countrymen, rather than by any fixed principle of action, was found side by side with the Prince of Orange, in the van of the malcontents. But in opposition to the popular movement came his strong feeling of

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loyalty to Spain, and his still stronger devotion to the Roman Catholic faith. Thus, the opposite forces by which he was impelled neutralized each other, and, ever acting from impulse, he did not calculate the consequences of his conduct. When these consequences came he was not prepared to meet them. See Motley, 'Rise of the Dutch Republic'; Juste, 'Le Comte d'Egmont et le Comte Hoorn' (1862); Goethe, 'Egmont,' a drama.

**Egmont.** See PORT EGMONT.

**Egoism**, ē'gō-izm (Fr. *égoïsme*; Lat. *ego*, 'I'), an ethical term used in the sense of selfishness; it is specially opposed to altruism. The word is sometimes used to denote a metaphysical system of subjective idealism, in which the Ego is the sole reality. See ALTRUISM; ETHICS.

**E'goist, The**, a novel by George Meredith, published 1879. It describes the experiences of Sir Willoughby Patterne, of Patterne, in selecting a wife.

**Egret**, ē'grēt, a name given to those species of white herons which have the feathers of the lower part of the back elongated and their webs disunited owing to the absence of barbs at certain seasons of the year, that they form a soft and flowing train reaching to the tail or beyond it. Their forms are more graceful than those of the common herons. The name is properly applied to two American and two European species. The American egret (*Ardca egretta*) has the plumage white, or partly of a creamy color. The bird is found breeding from Florida to New York, and along the shores of the Mexican Gulf to Texas, but ranges much beyond these limits at other seasons. Its food consists of the smaller quadrupeds, small fishes, frogs, lizards, snakes, and insects, and it breeds like other herons. The long silky filaments of the back are hardly to be seen, except about the love season, which varies from early spring to mid-summer according to climate; both sexes possess this train, and many are shot to obtain these feathers for ornamental purposes. The little white egret or snowy heron of America (*A. candidissima*) is much smaller and has a crest on the head which the large species lacks. In habits and distribution it is similar. The European egret (*A. alba*) is about 40 inches long, of a pure white plumage. It is common in southern Europe, but comparatively rare in the northern and central parts. The little egret (*A. garzetta*) is about 22 inches long from bill to end of tail; the plumage is white; from the hinder part of the head spring two narrow feathers four inches long. This species is most abundant in southern Europe and northern Africa; it occasionally wanders as far as England. The Louisiana heron (*A. tricolor*) and the reddish egret (*A. rufescens*) are often given the name, but the latter is white in winter only, and the former is partly colored at all seasons. Both are maritime birds, chiefly of the Gulf States.

**Egusquiza, Juan Batista**, hoo ān' bā-tēs'-tā ā-goos-kē'thā, Paraguayan statesman: b. Asuncion 1845. He was a lieutenant-colonel in the war with Uruguay, Brazil, and the Argentine republic, later being appointed secretary of war, and attaining the rank of general. He was elected president of Paraguay 1894.

**Eguzquiza, ā-gooth-kē'thā, Rogliode**, Spanish painter: b. Santander 1835. He studied at

the Ecole des Beaux Arts, Paris. Among his works are: 'Virgin with Rosary' (1859); 'Discussion Between Don Quixote and the Cure'; 'Michelangelo Beside the Body of Vittoria Colonna'; 'Charles V. at Convent of St. Juste' (1868), reproduced in popular engraving; 'Family Concert'; 'Master-at-Arms'; 'Portrait of Lady' (1878).

**Egypt** (in Greek *Aiguptos*; in Hebrew, *Misr* or *Misraim*; in the language of the country in hieroglyphics, *Kemi*—which signifies the black land; and by the Arabs of the present day called *Misr*), a country in the northeastern part of Africa. Egypt proper extends from the Mediterranean Sea south to lat 22° N., and from thence southward into equatorial Africa, which latter region, known as the Egyptian Sudan, is governed by Egypt and Great Britain jointly. The eastern boundary is the Red Sea, and on the extreme northeast Syria. The western boundary runs northwest to Tripoli, and thence southeast to a point 200 miles west of Wady-Halfa. One third of the Libyan Desert also belongs to Egypt. The area of Egypt is about 400,000 square miles, the country extending 675 miles north and south, and 500 miles east and west. Its population is about 11,000,000.

**Topography.**—In ancient as in modern times Egypt was always divided into the Upper and the Lower, or the Southern and the Northern, country; and at a very early period it was further subdivided into a number of *nomes*, or departments, varying in different ages; 42 was probably the usual number. A third great division, the *Heptanomis*, or seven nomes, preserved in the modern "Middle Egypt" (*Wustāni*), was introduced at the time of the geographer Ptolemy. Each nome or department had a separate local government. In the 5th century A.D. Egypt was divided into Augusta Prima and Secunda on the east, and Ægyptiaca on the west, Arcadia (the Heptanomis), Thebais Proxima as far as Panapolis, and Thebais Supra to Philæ. Under the Mohammedans, the triple division into Misr el-Bahri (Lower Egypt), el-Wustāni (Middle), and es-Sa'id (Upper) has prevailed, but the number of subdivisions has varied; at present there are altogether thirteen provinces. Egypt is connected with Asia by the isthmus of Suez, across which runs the great canal, about 100 miles long. The inhabited portion of Egypt is mainly confined to the valley and delta of the Nile, which where widest does not exceed 120 miles, while in many parts of the valley it is only from 10 to 15 miles wide, at the southern frontier of Egypt only two miles. West of the Nile are several oases. Two ranges of lofty mountains, the Arabian Hills on the east and the Libyan on the west, enclose this valley. The delta of the Nile is traversed by a network of primary and secondary channels, and is also intersected by numerous canals. Seven principal channels or mouths were usually recognized in ancient times, the names of which, going from east to west, were the Pelusiatic mouth, the Tanitic, the Mendesian, the Phatnitic (Damietta), the Sebennytic, the Bolbitic (Rosetta), and the Canopic. The Nile has a current running seaward at the rate of 2½ or 3 miles an hour, and the stream is always deep enough for navigation. The water becomes a reddish brown during the annual overflow; it is esteemed highly salubrious. Near the sea are Lake Menzaleh



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Mariut (Mareotis), and other extensive but shallow lagoons. The openings or lateral valleys of the hills confining the valley of the Nile are comparatively few, or, being little frequented, are not well known. Those on the east side with which we are best acquainted are the Valley of the Wanderings (of the children of Israel), leading from the neighborhood of Cairo to the head of the Gulf of Suez, and that through which passes the road from Koptos to Kosseir on the Red Sea. A short distance west of the Nile and above the delta is the fertile valley of Fayoum in the northwest and lowest part of which is the Birket-Karun Lake or Birket-el-Kerûn, fed by a canal or branch from the Nile. The level of the lake is now 130 feet below that of the Mediterranean. This lake, formerly known as Lake Meris, anciently covered a far larger area, and by means of sluices and other works was utilized for irrigation purposes. The deserts on the west bank of the Nile generally present to view plains of gravel or of fine drifting sand; on the east the scene is varied by rocks and mountains.

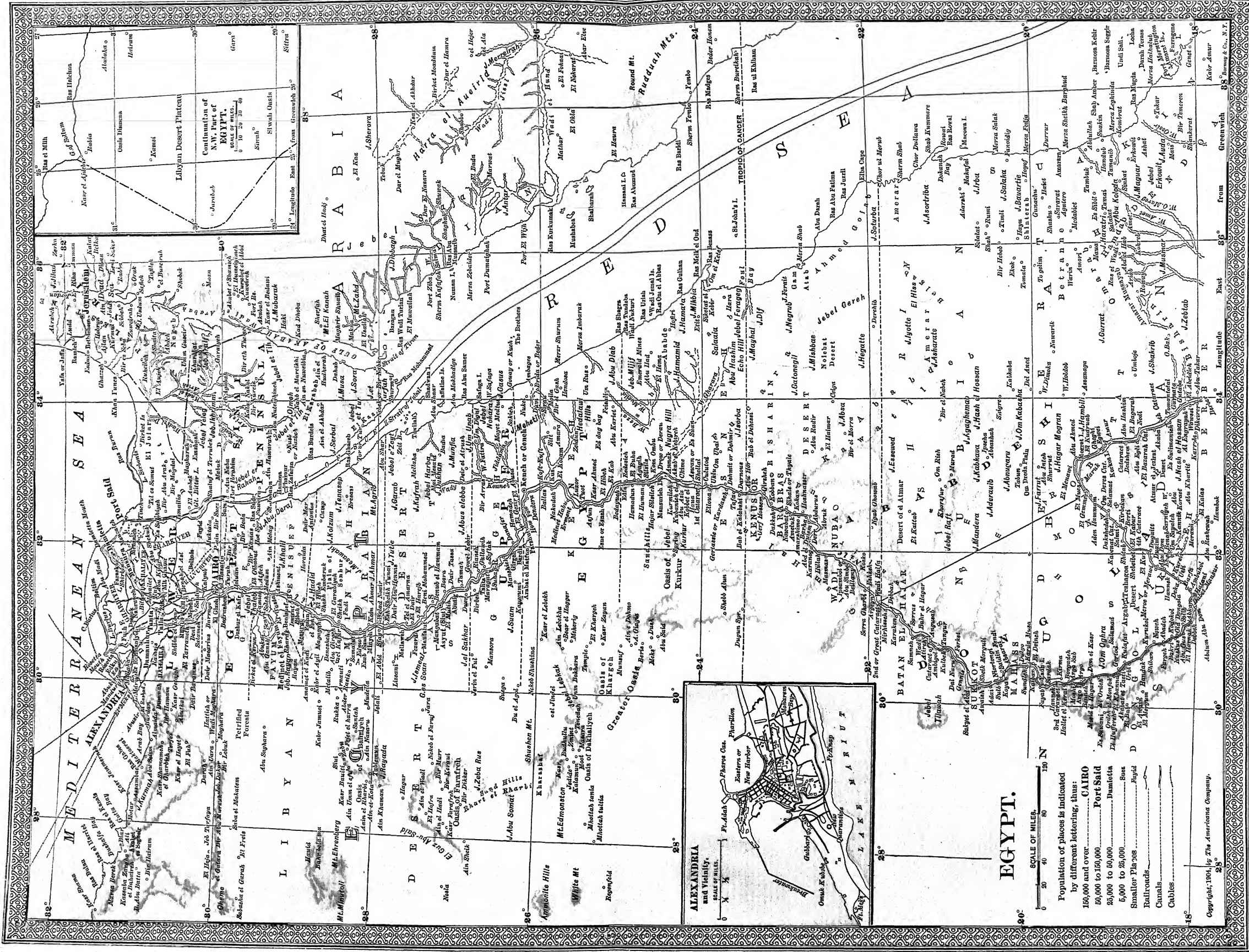
*Climate.*—The atmosphere in Egypt is extremely clear and dry, the temperature regular and hot, though the heat is tempered during the daytime for seven or eight months of the year by the strong wind which blows from the north, and which enables sailing vessels to ascend the river against the stream. The winter months are the most delightful of the year, the air being cool and balmy, and the ground covered with verdure; later, the ground becomes parched and dry, and in spring the suffocating *khamsen*, or simoom, frequently blows into the Nile valley from the desert plains on each side of it, raising clouds of fine sand, and causing great annoyance, until the rising of the river again comes to bless the land. It rains but rarely, except near the sea-shore. At Memphis the rain falls perhaps three or four times in the course of a year, and in Upper Egypt only once or twice, if at all; showers of hail sometimes reach the borders of Egypt, but the formation of ice is very uncommon. Earthquakes are occasionally felt, and thunder and lightning are neither frequent nor violent. Egypt is not remarkably healthy, especially in the delta, ophthalmia, diarrhœa, dysentery, and boils being somewhat prevalent. But many invalids now winter in Egypt, especially in the neighborhood of Cairo, or higher up the river, where the air is dry and pure.

*The Nile and Irrigation.*—The great historic river Nile, anciently called the Nilus, is 3,400 miles in length, the longest in Africa and one of the few great rivers of the world. It divides, at lat.  $30^{\circ} 15'$ , just below the First Cataract, into two main streams, the one entering the sea by the Rosetta mouth on the west, the other by the Damietta mouth on the east. These two streams carry the bulk of the Nile water to the Mediterranean, and inclose a large portion of the territory known as the delta, from its resemblance to the Greek letter  $\Delta$  and which owes its existence to the deposits of alluvial matter brought down by the stream. The most remarkable phenomenon connected with the Nile is its annual regular increase, arising from the periodical rains which fall within the equatorial regions and the Abyssinian Mountains. As rain rarely falls in Egypt, the prosperity of the country entirely depends on this overflowing of the river. On the subsiding of the water the land is

found to be covered with a brown slimy deposit, which so enriches the soil that with a sufficiency of water it produces two crops a year, while beyond the limits of the inundation and irrigation there is no cultivation whatever. The Nile begins to rise in June, and continues to increase until about the end of September, overflowing the low lands along its course, the water being conveyed to the fields by artificial courses where natural channels fail. After remaining stationary for a short time, the river rises again still further, but subsequently begins to subside, showing a markedly lower level in January, February, and March, and reaching its lowest in April, May, and early June. The overflow water is now to a great extent managed artificially by means of an extensive system of reservoirs and canals, so that after the river subsides it may be used as required. A certain proportion of the fields, after receiving the overflow and being sown, can ripen the crop without further moisture; but many others always require artificial irrigation. Steam pumps are now largely used in northern Egypt. Latterly the government has tried to make the farmers less and less directly dependent on the inundation, and the great barrage of the Nile below Cairo, the largest weir in the world, is one means to this end, the great dam or barrage at Assouan being another.

The native methods of raising water for irrigation are chiefly by the *sakieh*, or water wheel, and the *shadouf*. The first consists of a horizontal wheel turned by one or two oxen, which sets in motion a vertical wheel, around which are hung a number of earthen jars, this wheel being sunk into a reservoir connected with the river. The jars thus scoop up the water and bring it to a trough on a level with the top. Into this trough each jar empties itself in succession, and the water is conducted by an inclined channel into the cultivated ground adjoining, which may have been previously divided into compartments of 1 or 2 yards square by raising the mold into walls or ridges of 5 or 6 inches in height. Into these compartments the cultivator forms an entrance for the water, by depressing a little space in the ridge or wall with the sole of his foot; and this overlooking of the channels of irrigation, and adjustment of the openings from one compartment to the other with the foot, is continued till the cultivator is assured by the growth of the plants that each compartment is daily and duly supplied with its proper quantity of water. The second means of raising water, namely, the *shadouf*, consists of a leathern bucket slung at one end of a pole which has a weight at the other and sways up and down on a vertical support, a contrivance by which the cultivator is enabled to scoop up the water considerably below his feet, and raise it with comparative ease to the mouth of a channel on a level with his breast. The latter mode of raising water is of great antiquity, and is depicted on the walls of the ancient tombs of Egypt, and also in the sculptures from Nineveh. A sufficient rise of the river (the rise varies at different points) is essential to secure the prosperity of the country; and as the water subsides, the chaplet of buckets on the *sakieh* is lengthened, or several *shadoufs*, rising one above the other on the river bank, are required. Should the Nile rise above the requisite height it may do great damage; while if it should not attain the







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ordinary height, there is a deficiency of crops; but so regular are the operations of nature that, with rare exceptions, the inundations are nearly uniform. See DELTA; IRRIGATION; RIVER.

**Oases.**—The fertile spots peculiar to the deserts of Africa are found in Egypt along the hollow region of the Libyan Desert, parallel to the general direction of the valley of the Nile, and above 80 miles west of it. The Great Oasis, or El Wah (the oasis), el Khargeh, lies immediately west of the Thebaid, and has a length of 100 miles. About 50 miles west of the northern extremity of this oasis lies the Wah el Dakhileh, 24 miles long and 10 miles broad. West by south from the Fayoum the date groves of the Little Oasis, or Wah el Baharieh, display their unusual verdure. In this fertile spot artesian wells are numerous, and some of ancient construction have been discovered which have a depth exceeding 400 feet. On the road between this oasis and that of El Dakhileh, inclining to the west, occurs half-way the Wah el Farafrah, of small extent. West of the Fayoum, and about 200 miles from the Nile, lies the oasis of Siwah. The inhabitants of this secluded spot, though tributary to Egypt, are in language and manners wholly Libyan. The region of the oases terminates toward the north in the desert of the Natron lakes. See OASIS.

**Zoology.**—Owing to the absence of forests in Egypt there are few wild animals, the principal species being the wolf, fox, jackal, hyena, the wild ass, and several kinds of antelope. The chief domestic animals are camels, horses, asses, horned cattle, and sheep. The hippopotamus is no longer found in Egypt, though it is met with in the Nile above the cataracts, and the crocodile has abandoned the lower part of the river, and is becoming rare even in Upper Egypt. Among the birds are three species of vultures (one of which is very large, individuals sometimes measuring 15 feet across the wings), eagles, falcons, hawks, buzzards, kites, crows, linnets, larks, sparrows and the beautiful hoopoe, which is regarded with superstitious reverence. Pigeons and various kinds of poultry are very abundant. The ostrich is found in the deserts. Among the reptiles are the cerastes and naja haje, both deadly poisonous. Fishes abound in the Nile and in the lakes, and furnish a common and favorite article of food. Water-fowl are plentiful, and were anciently prepared and salted like fish. The sacred ibis is still a regular visitor during the inundation, and the pelican is found in the northern lagoons. Among the countless insects are the sacred beetle, the locust, and mosquito. Many of the animals, birds, and reptiles were held sacred by the people; whoever killed a sacred animal, an ibis or a hawk, was put to death. If a cat died a natural death every person in the house shaved his eyebrows; if a dog died, the whole body and the head were shaved. The cats were buried at Bubastis, the dogs in the vaults of their own cities, field-mice and hawks at Buto, the ibis at Hermopolis, and other animals where they were found lying. Of all animals the sacred calf Apis was the most revered. His chief temple was at Memphis. The females, being sacred to Isis, were thrown into the Nile, which was considered sacred, and the males were buried at Sakkara.

**Botany.**—The few trees found in Egypt include the date-palm, tamarisk, sycamore,

Christ's-thorn, carob, and two species of acacia. Many trees have been planted in recent times, especially about Cairo, such as the lebbek (*Albizia Lebbek*) and the eucalyptus. The papyrus plant, once so important, is now to be found only in one or two spots. Of it was manufactured a paper, which was supplied to all the ancient world. Boats, baskets, cords, and shoes were also made of it. Wine was abundantly produced in ancient Egypt, and the sculptures bear ample testimony to the extent to which the ancient Egyptians indulged in wine and beer or other intoxicating beverages. The vine is still much cultivated, but little or no wine is made, as it can easily be imported. The following plants are sown immediately after the inundation begins to subside, and are harvested three or four months later: wheat, barley, beans, peas, lentils, vetches, lupins, clover, flax, lettuce, hemp, coriander, poppies, tobacco, watermelons, and cucumbers. The following plants are raised in summer chiefly by artificial irrigation: durra, maize, onions, henna, sugarcane, cotton, coffee, indigo, and madder. Grapes are plentiful, and other fruits abound, of which the most common are dates, figs, pomegranates, apricots, peaches, oranges, lemons, citrons, bananas, mulberries, and olives. The lotus or water-lily is the chief species of flora found in Egypt. There is a high coarse grass called halfa and various kinds of reeds and canes.

**Geology and Mineralogy.**—Granite, limestone and sandstone are the principal rock formations found in Egypt. In the Nile Valley sandstone prevails, from the quarries of which most of the temples of Egypt have been built. At Syene, at the southern extremity of the country, granite predominates, and the quarries there have furnished chiefly the materials for the obelisks and colossal statues of Egypt. Over a great extent of the country the rocks are covered with moving sands, and in the lands bordering on the Nile by the alluvium deposited during the inundations, which consists of an argillaceous earth or loam, more or less mixed with sand. This sedimentary deposit has no traces of stratification. Various other minerals in addition to those already mentioned, and which were used in the ancient buildings, sculpture, vases, etc., include syenite, basalt, alabaster, breccia, and porphyry. Among other valuable products were emeralds, gold from the mines in Upper Egypt, iron from the desert plains of Nubia, and natron from the lakes in the Oasis of Ammon, hence called sal-ammoniac. Bitumen, salt, and sulphur are also among the minerals of Egypt.

**Inhabitants.**—Of the inhabitants of Egypt those of the peasant class, or Fellahs, as they are called, are undoubtedly indigenous, and may be regarded as descendants of the ancient Egyptians. They have mostly embraced Mohammedanism. The Copts are the descendants of the ancient Egyptians who embraced and still cling to the Christian religion. Though comparatively few in number (about 600,000), their education and useful talents enable them to hold a respectable position in society. The Fellahs are generally peasants and laborers; the Copts fill the posts of clerks, accountants, etc. With these aboriginal inhabitants are mingled, in various proportions, Turks, Arabs (partly Bedouins), Armenians, Berbers, negroes, and a considerable number of Europeans. The Turks hold many of



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the principal offices under the government. The great bulk of the people are Mohammedans, the Christians being only about 7.5 per cent. The Egyptians in the mass are quite illiterate, but under the supervision of the ministry of public instruction progress is being made. In 1902 there were about 10,000 schools with 228,000 pupils. The language in general use is Arabic.

The Fellahs, the most superior type of the Egyptian, are a fine race, handsome, of excellent physique, and courteous in their manners. In northern Egypt they are of a yellowish complexion, growing darker toward the south, until the hue becomes a deep bronze. Mr. Lane, the best authority upon the subject, speaks highly of their mental capacity, and gives them credit for uncommon quickness of apprehension and readiness of wit. They are highly religious, and are generally honest, cheerful, humane, and hospitable. But these are exceptions in a mixed population of Bedouins, negroes, Abyssinians, Turks, Syrians, Greeks, Armenians, Jews, and Europeans. The dominant population appears, from the language, and from the physical conformation of the mummies, to have been of mixed origin, part Asiatic and part Nigritic; and there seems to have been an aboriginal race of copper color, with rather thin legs, large feet, high cheek-bones, and large lips; both types are represented on the monuments. The statements of Greek writers that a system of castes prevailed in Egypt are erroneous. What they took for castes were really conditions of society, and the different classes not only intermarried, but even, as in the case of priests and soldiers, held both employments. As in all bureaucracies, the sons often obtained the same employments as their fathers. The population must have been very large at the earliest period, as 100,000 men were employed in the construction of the Great Pyramid alone during the 4th dynasty, nearly 3600 years B.C. It has been placed at 7,000,000 under the Pharaohs, distributed in 1,800 towns, which had increased to 2,000 under Amasis (525 B.C.), and upwards of 3,000 under the Ptolemies. In the reign of Nero it amounted to 7,800,000. The population in 1844 was 2,500,000; in 1859, 5,125,000; in 1882, 6,817,265, and in 1897, 9,734,405. The population in 1903 is estimated at 11,000,000, which includes 40,175 Greeks, 24,467 Italians, 19,557 British, and 18,155 French. The chief towns of Egypt proper are Cairo (pop. 600,000); Alexandria (250,000); Damietta (35,000); Tantah (34,000); Assiout (32,000); Mansourah (27,000); Fayoum (26,000); Damanhour (24,000); Zagazig (19,000); Rosetta (17,000); Port Saïd (16,500); Suez (11,000). See BEDOUINS; COPTS; FELLAHS.

**Government.**—The ancient government of Egypt was a monarchy, limited by strict laws and by the influence of powerful hereditary privileged classes of priests and soldiers. The priests were the ruling class. They were restricted to a single wife, and if polygamy was permitted to the rest of the people, it must have been very seldom practised. The marriage of brothers and sisters was permitted. The laws were wise and equitable, and appear to have been rigidly enforced. Murder was punished with death, adultery by bastinadoing the man and by cutting off the nose of the woman, forgery by cutting off the culprit's hands. Imprisonment for debt was not permitted, but a man could pledge to his creditors the mummies

of his ancestors, and if he failed in his lifetime to redeem them, he was himself deprived of burial. Women were treated with respect, and the laws and customs seem to have been so favorable to them that their condition in Egypt was much higher than in any other nation of antiquity. The military force of Egypt was a species of hereditary militia, which formed one of the leading classes or castes, and in time of peace cultivated the land, of which it held a large portion. The king's guards, some few thousands in number, were the only standing army. The number of soldiers in the military caste is stated by Herodotus at 410,000, which probably included all the men of that class able to bear arms. It is not probable that the whole of them ever were or could be brought into the field at once. Their arms were spears and swords, and they were protected by large shields.

At the present day the government is in the hands of the viceroy or khedive, as supreme ruler, who pays an annual tribute of about \$3,000,000 to Turkey, and is assisted by a ministry formed on the model of those of western Europe. The capital is Cairo. The government is carried on under the supervision of Great Britain, the rebellion of Arabi Pasha in 1882 having been put down and the authority of the khedive restored by British troops. For some years previous to this two controllers-general, appointed respectively by France and Britain, had extensive powers of control in the administration of the country. The British have initiated various reforms in the administration, such as the establishment of new native tribunals. The administration of justice is somewhat complicated, there being native tribunals, consular courts, mixed tribunals, and religious courts. The financial condition of Egypt is being slowly improved under British management. The Egyptian army is under the command of an English general, and officered partly by Englishmen and partly by Egyptians; its total strength is 18,100, while the English army of occupation, which, since the rebellion of 1882, has remained in Egypt, has a strength of 5,600.

**Commerce and Industry.**—Agriculture, manufacture and trade were carried on in Egypt in the very earliest days. Upon the ancient monuments we find representations of the mechanical arts, and we see the blow-pipe, bellows, and siphons; the press, balance, lever, the saw, the adze, the chisel, the forceps, the syringe, harpoon, razors; we have also glazed pottery, the potter's wheel, and the kiln; and dated specimens of glass of the time of Thothmes III. (1445 B.C.) Gold-beating, damascening, engraving, casting, inlaying, enameling, wire-drawing, and other processes were practised. In warfare, shields, cuirasses of quilted leather, helmets, spears, clubs, maces, daggers, bows, battle-axes, pole-axes, hatchets, and falchions; for sieges the testudo, ladders, torches, and lanterns were in use. In agriculture the plough, hoe, sickle, and other implements were employed. The processes of growing and preparing flax, and making it into thread, string, ropes, and cloth, as well as the looms employed, are all depicted. Mats and baskets were beautifully made, either of the halfa grass or palm leaves, or of the outer rind of the papyrus plant, which was used in making paper. Coffins or wooden sarcophagi were chiefly of sycamore or



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cedar, covered with stucco and richly painted. The ordinary boats of the Nile were of planks of the acacia, and had two rudders or large oars, with a sail of cloth frequently painted or worked in colored patterns. Many of the vessels of burden were of great size. The boats made of papyrus were mostly punts for fishing, or for gliding through the canals of the Delta. Implements for painting, ladles, bells, crucibles, and surgical instruments have also been found. The commerce of the Egyptians with neighboring nations enriched the country with slaves, cattle, gems, metals, rare animals, and objects of curiosity. The Egyptians expended enormous wealth on the tombs and furniture of the dead, and the paintings acquaint us fully with the various ceremonies followed. In embalming they excelled.

To-day the one branch of industry for which Egypt is peculiarly adapted by nature is agriculture, and large quantities of cereals, cotton, and other agricultural produce are raised; yet, generally speaking, agriculture is still in a very low state, the necessary consequence of the wretched condition and extreme poverty of those engaged in it. The Egyptians still adhere to their ancient custom of uniting the followers of each business or profession into a guild, governed by their sheikh, who acts, if need be, as their representative. These guilds are exceedingly numerous, as might be expected among a people whose social organization dates from a remote antiquity.

Among the crops which the Egyptians grow with success, cotton is the most popular and profitable. (See *COTTON*.) The cotton plant of Egypt differs materially, in one respect at least, from that of other countries. In America it has been found unprofitable to allow the plants to continue in the ground longer than one year. In Egypt, however, the case is different, for the cotton plant yields five, and sometimes six, consecutive crops before replanting is found to be necessary. This being the case, a cotton field once planted is a secure investment for at least five years, and as peasants of the Nile do not love labor, more cotton is grown in Egypt in proportion to the population engaged in agriculture than in any other part of the world. In both Upper and Lower Egypt cotton is therefore the standard crop, and as it is not troubled with worms as in America, and by the method of irrigation the farmer can give it exactly the right portion of moisture and no more, the crop is tolerably reliable. The boats transport the product to Cairo or to Alexandria, the leading cotton markets. The exchange in the former city is located on one of the principal streets, while the market proper is in a public square opposite the great Mosque of Hassan. The time of the river journey to Alexandria is from six days to six months, for, as the Mohammedans say, "God is great, and there is no hurry."

The business of tanning also is one in which the Egyptians succeed perfectly, by a process peculiar to themselves. They make excellent morocco leather, which is goatskin dressed and dyed in a particular manner. The pottery of Egypt also deserves a word of praise, chiefly for the merit of the bardaks or water-jars. Coarse cotton cloths, and cloths of mixed cotton and wool, are largely made in the country; silk is cultivated to some extent; and the cultivation of the sugarcane received a great im-

pulse from the viceroy, Ismail, who erected a number of mills at great expense. Goods carried by the Suez Canal do not form part of the commerce of the country, and the transit trade proper is of little importance. The exports of Egypt for 1902 amounted to £19,451,460 and the imports £16,649,145. The public debt (1901) amounts to £103,264,540. The railway system, under government control, embraces 2,173 miles and nearly 2,877 miles of telegraph lines.

*History.*—The history of Egypt, prior to the beginning of the ancient empire 4000 B.C., is entirely mythical. The history divides itself into six great periods: (1) The Pharaohs or native kings; (2) the Persians; (3) the Ptolemies; (4) the Romans; (5) the Arabs; (6) the Turks.

The main sources of its history under the Pharaohs are the Scriptures, the Greek writers Herodotus, Diodorus, and Eratosthenes, some fragments of the writings of Manetho, an Egyptian priest in the 3rd century B.C. From the Scriptures we learn that the Hebrew patriarch Abraham went into Egypt with his family because of a famine that prevailed in Canaan. He found the country ruled by a Pharaoh, the Egyptian term for king. The date of Abraham's visit, according to the chronology of the Hebrew text of the Bible, was 1920 B.C.; according to the Septuagint, 2551; while Bunsen fixes it at 2876. Nearly two centuries later Joseph, a descendant of Abraham, was sold into Egypt as a slave to the captain of the guards of another Pharaoh, whose prime minister or grand vizier the young Hebrew eventually became. Joseph's father, Jacob, and his family, to the number of 70, accompanied, as Bunsen conjectures, by 1,000 or 2,000 dependents, followed their fortunate kinsman into Egypt, where they settled in a district called the land of Goshen. There they remained until their numbers had multiplied into two or three millions, when under the lead of Moses they revolted and quitted Egypt to conquer Canaan.

Menes was the first king of Egypt, and was succeeded by 330 monarchs, of whom one, Nitocris, was a queen. None of them were distinguished, and none of them left any monuments worthy of note, except Moeris, the last of the 330, who constructed the artificial lake which bears his name. He was succeeded by Sesostris, who conquered Ethiopia and the greater part of Europe and Asia. His successors were Pheron, Proteus (who was contemporary with the Trojan war), Rhampsinitus, Cheops, Cephren, and Mycerinus. The last three kings built the three great pyramids. Mycerinus was succeeded by Asychis, and Asychis by Anysis, in whose reign Egypt was conquered by the Ethiopians, who held it for 50 years under King Sabaco. At the expiration of the half century they voluntarily abandoned the country and retired to Ethiopia. The next king of Egypt was Sethos, between whom and the first king Menes, the priests told Herodotus, there had been 341 generations, a period of 11,340 years. Sethos was succeeded by 12 kings, who reigned jointly, and together built the Labyrinth, which Herodotus thought surpassed all the works of the Greeks. After the lapse of some years, Psammetichus, one of the 12 kings, dethroned the others and made himself sole sovereign of Egypt. He was succeeded by Necho, Psammis, and Apries, the last of whom Herodotus calls

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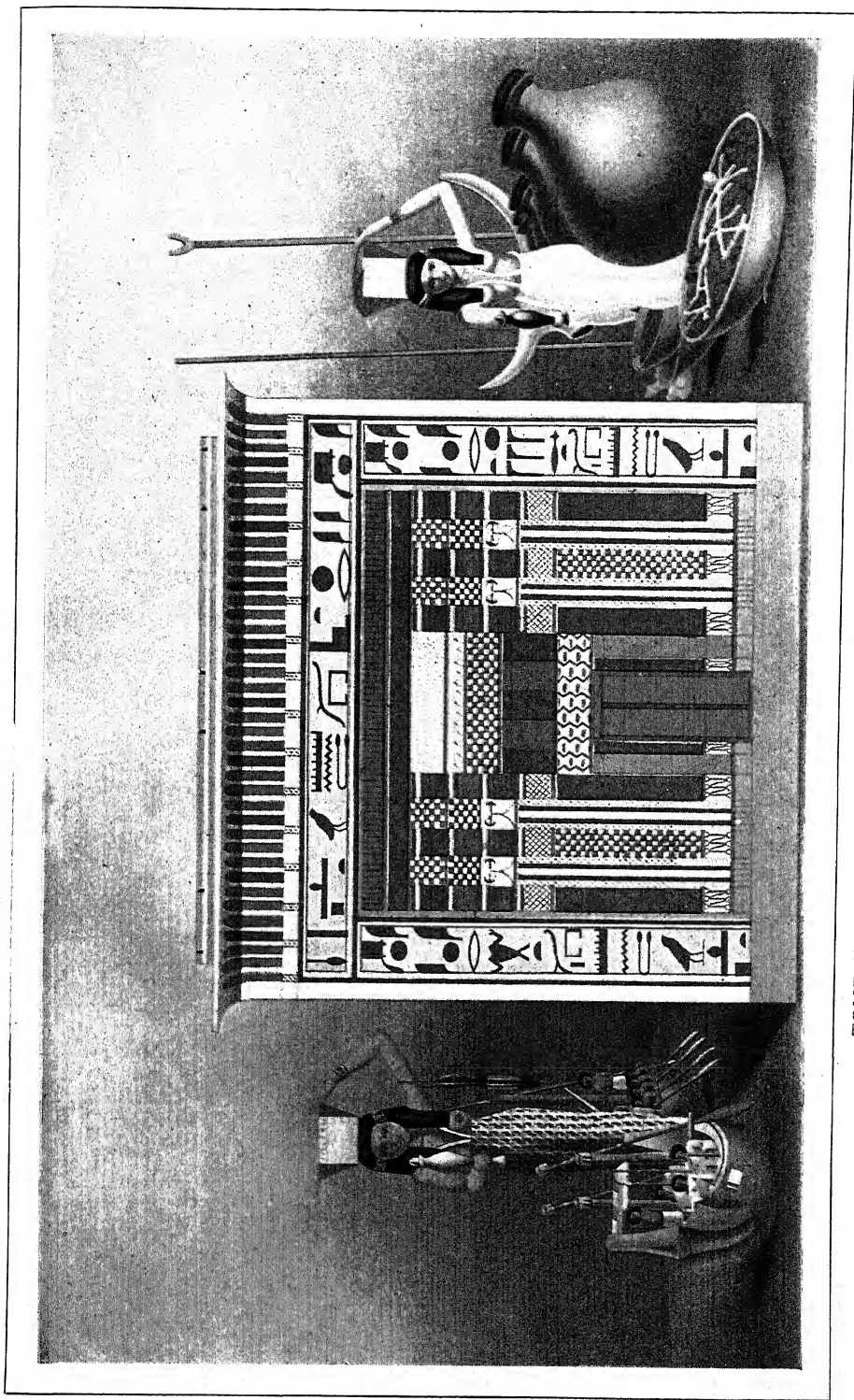
the most prosperous king that ever ruled over Egypt. But in the 25th year of his reign a rebellion broke out which was headed by Amasis. Apries was defeated and put to death, and Amasis became king. Amasis was succeeded by his son Psammenitus, at the very beginning of whose reign, 525 B.C., Egypt was invaded and conquered by the Persians under Cambyses.

Cambyses treated Egypt with considerable moderation, but after an unsuccessful expedition against the Ethiopians, lost his reason, stabbed the bull Apis, and committed various atrocities. His successor, Darius I., governed Egypt with more prudence; but Xerxes I. and Artaxerxes I. had successively to reduce it to subjection, which they did in spite of assistance rendered to it by the Athenians. The 27th dynasty of Persians was followed by another Saïte line, the 28th, who still held ground against the Persians. The 29th, Mendesian, dynasty of Nephherches and Achoris maintained a Greek alliance; and the 30th, Sebennytic, consisted of Nectanebes I., who successfully resisted Pharnabazus and Iphicrates, of Teos, who employed Agesilaus, and of Nectanebes II., who fled into Ethiopia before the Persians (340 B.C.). In 332 B.C. the Persians were driven out by Alexander the Great, with whom begins a new period, the Græco-Roman, in the history of the country.

When Alexander's army occupied Memphis the numerous Greeks who had settled in Lower Egypt found themselves the ruling class. Egypt became at once a Greek kingdom, and Alexander showed his wisdom in the regulations by which he guarded the prejudices and religion of the Egyptians. He founded Alexandria as the Greek capital, and this city became the great centre of commerce and Greek civilization that it long continued to be. The court of the Ptolemies became the centre of learning and philosophy; and Ptolemy Philadelphus, successful in his external wars, built the Museum, founded the library of Alexandria, purchased the most valuable manuscripts, engaged the most celebrated professors, and had the Septuagint translation made of the Hebrew Scriptures, and the Egyptian history of Manetho drawn up. His successor, Euergetes, pushed the southern limits of his empire to Axum. Philopator (221-204 B.C.) warred with Antiochus, persecuted the Jews, and encouraged learning. Epiphanes (204-180 B.C.) encountered repeated rebellions, and was succeeded by Philometor (180-145 B.C.) and Euergetes II. (145-116 B.C.), by Soter II. and Cleopatra till 106 B.C., and by Alexander (87 B.C.), under whom Thebes rebelled; then by Cleopatra Berenice, Alexander II. (80 B.C.), and Neos Dionysus (51 B.C.), and finally by the celebrated Cleopatra. After the battle of Actium (31 B.C.) Egypt passed into the condition of a province of Rome, governed always by a Roman governor of the equestrian, not senatorial, rank. The Egyptians had continued building temples and covering them with hieroglyphics as of old; but on the spread of Christianity the older religions lost their sway. Now arose in Alexandria the Christian catechetical school, which produced Clemens and Origen. Monasteries were built all over Egypt; Christian monks took the place of the pagan hermits, and the Bible was translated into Coptic.

On the division of the great Roman empire (337 A.D.), in the time of Theodosius, into the Western and Eastern empires, Egypt became a province of the latter, and sank deeper and deeper in barbarism and weakness. It then became the prey of the Saracens, Amru, their general, under the Caliph Omar, taking Alexandria, the capital by assault. This happened 640 A.D., when Heraclius was the emperor of the East. As a province of the caliphs, it was under the government of the celebrated Abbassides—Harun al-Rashid and Al-Mamon—and that of the heroic Sultan Saladin. The last dynasty was, however, overthrown by the Mamelukes (1240), and under these formidable despots the last shadow of former greatness and civilization disappeared. Selim Sultan of the Turks, eventually (1516-17) conquered the last Mameluke sultan, and Egypt became altogether a Turkish province, governed by a pasha. After this it was the theatre of internal wars by the Mameluke beys against the Turkish dominion, which was several times nearly extinguished. Confusion and civil war between the different factions of the Mamelukes continued to prevail till 1798, when the French invasion under Napoleon Bonaparte united their chiefs in self-defense; but the Mameluke army was all but annihilated in the battle of the Pyramids. The French now conquered the whole of Egypt and held it till 1801, when they were driven out by the British under Abercromby and Hutchinson.

On the expulsion of the French the Ottoman porte effectually urged its claim to sovereignty, and the accession of the Albanian soldier, Mohammed 'Ali to the pashalik in 1805 imparted a galvanic prosperity to Egypt, by the merciless destruction of the turbulent Mamelukes (whom a disastrous British expedition in 1807 vainly sought to restore), the formation of a regular army, the increase of security, the improvement of the irrigation, and the introduction of the elements of European civilization. In 1816 Mohammed 'Ali reduced part of Arabia to his sway by the generalship of his son, Ibrahim; in 1820 he annexed Nubia and part of the Sudan, and from 1821 to 1828 his troops, under Ibrahim, occupied various points in the Morea and Crete, to aid the Turks in their war with the insurgent Greeks. The Egyptian fleet was annihilated at Navarino, and Ibrahim remained in the Morea till forced to evacuate by the French army, under Maison, in 1828. In 1831 Ibrahim began the conquest of Syria, and in the following year totally routed the Ottoman army at Koniya, after which the porte ceded Syria to Mohammed 'Ali on condition of tribute. War breaking out again, the victory of Nisib in 1839 would perhaps have elevated him to the throne of Constantinople; but the quadruple alliance in 1840, the fall of St. Jean d'Acre to the British, and the consequent evacuation of Syria, compelled him to limit his ambition to the pashalik of Egypt. In 1848 Mohammed 'Ali became imbecile (he died in 1849), and his son Ibrahim sat on his throne for two months, when he died, and was succeeded by 'Abbās Pasha, Mohammed 'Ali's grandson, superseded in turn by Sa'id Pasha, youngest son of Mohammed 'Ali, in 1854. M. de Lesseps now obtained the co-operation, hitherto withheld, of the Egyptian government in his scheme of the Suez Canal, which was opened in 1869. Sa'id was succeeded in 1863 by his nephew, Isma'il, son of Ibrahim,



TOMB IN THE VALLEY OF EL ASSASSIF, THEBES, EGYPT



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who, by a firman purchased from the Sultan, took in 1866 the hereditary title of Khedive. The same firman made the succession to the throne of Egypt direct from father to son, instead of descending, according to Turkish law, to the eldest male of the family; and in 1872 the Sultan granted to the Khedive the rights (withdrawn in 1879) of concluding treaties and of maintaining an army, and virtually gave him sovereign powers. Thus secure on an hereditary throne, Isma'il began a series of vast internal reforms, built roads, bridges, lighthouses, laid down railways, and telegraphs, reconstructed the postal service, improved the harbors at Suez, Port Saïd, and Alexandria, supported education, and introduced mixed courts of law. Extending his dominions southward, he annexed Dar-Fûr in 1874, and in that and the following year further conquests were made. The condition of the finances led to the establishment of "dual control" by Great Britain and France, and in 1879 Isma'il was forced to abdicate under pressure of the British and French governments, and was replaced by his son, Tewfik. His position was soon threatened by the so-called National party with Arabi Pasha at its head, who aimed at his deposition and at the abolition of European intervention. In May 1882, a rising took place in Alexandria, when many Europeans were killed and their houses pillaged. The Khedive fled from Cairo, where Arabi remained autocrat. The French refusing to interfere, Great Britain determined to act, and on 11 July a British fleet bombarded the forts at Alexandria, causing the rebels to retreat. In August a force under Sir Garnet (afterward Lord) Wolseley landed at Ismailia, and on 13 September Arabi's forces were totally defeated at Tel-el-Kebir, and the rebellion crushed, Arabi and his associates being banished. Before this a rebellion against Egyptian rule had broken out in the Sudan under the leadership of Mohammed Ahmed, who professed to be a Mahdi or divinely-sent Mohammedan conqueror. His followers soon became numerous, defeated Egyptian troops that opposed them, and threatened the existence of all the Egyptian garrisons in the Sudan. In 1883 they annihilated an Egyptian force under Hicks Pasha near El Obeid in Kordofan, and in 1884, Osman Digna, as representing the Mahdi, defeated another force under Baker Pasha near Suakim. British troops were now despatched to Suakim, and at El Teb and Tamai severe defeats were inflicted on the Arabs by Gen. Graham. Meantime Gen. Gordon had been sent to Khartum to withdraw the garrisons from the Sudan, but he was shut up in the town for nearly a year, and perished before the relief expedition under Sir Garnet Wolseley could reach him (January 1885). The Sudan was then given up, and the southern boundary of the Egyptian dominions fixed at Wady Halfa.

In 1892 Tewfik died, and was succeeded by his son, Abbas Hilmi, who is the seventh viceroy and third khedive of Egypt. In 1896 an Anglo-Egyptian expedition for the reconquest of the lost provinces was despatched under Sir Herbert (now Lord) Kitchener. Dongola was soon occupied. Abu Hamed was captured in the following year, and 8 April 1898, the insurgents were defeated in a battle near the confluence of the Atbara. Finally, on 2 Sept. 1898, the forces of the khalifa, as the Mahdi's successor was

called, were defeated with great slaughter at Omdurman, beside Khartum. The territory thus reconquered was placed under a governor-general, and was rapidly organized. A subsequent attempt of France to occupy Fashoda and enforce a claim to the Bahr-el-Ghazal valley led to some friction with Great Britain. See ALEXANDRIA; CAIRO; CLEOPATRA; EMIN PASHA; GORDON, GEN. C. G.; ISHMAILIS; KHEDIVE; MAHDI, MOHAMMEDANISM; MOSES; NAPOLEON; PHARAOH; PTOLEMY; SUDAN; SUEZ CANAL; TEWFIK; WADY HALFA.

*Religion.*—The ancient Egyptian religion was a philosophical pantheism, the various attributes of the Deity being divided among the different gods of the Pantheon. Unlike the Greek, where a god was honored in a separate temple, each Egyptian divinity was accompanied by a *put* or "company" of companion-gods. The principal nomes and cities had each a family group of gods, consisting of a parent deity, a wife and sister, and a son. Thus Ptah or Hephæstus, the eponymous and principal god of Memphis, formed a triad with the goddess Sekhet or Bast, and Imhotep; at Thebes the triad was Amen-ra, Mut, and Khons; and at Apollinopolis Magna, Har-bahud (Horus), Hathor, and Har-pakhrut (Harpocrates). These triads were usually, if not always, accompanied by inferior deities completing the *put*; and personifications of the elements, passions, and senses were introduced. The worship of some triads, however, became universal—that of Osiris, Isis, and Horus being found all over Egypt at the earliest period. The gods, indeed, are stated by the Greeks to have been divided into three or more orders or systems. The gods of the Memphite order were Ptah, Ra, Shu, Seb, Osiris, Set, or Typhon, and Horus; and Amen, Mentu, Atmu, Shu, Seb, Osiris, Set, Horus, and Sebak, according to the Theban system. Difficulties arise from the tendency to fuse different gods into one, particularly at a later period; Amen-ra, for example, being identified with Horus; and Horus, Ra, Khnum, Mentu, and Tum being merely considered the sun at different periods of his diurnal course.

A few foreign deities became at the close of the 18th dynasty engrafted into the religious system—as *Bar*, Baal; *Ashtarata*, Ashtaroth; *Anta*, Anaitis; *Ken*, Kiun; *Reshpu*, Reseph; *Set*, or Sutekh, sometimes identified with Baal. All the gods had human passions and affections, and their mode of action was material; they walked on earth, or sailed through ethereal space on boats. First among the deities comes Ptah, the opener, represented as a bow-legged dwarf or embryo, the Phœnician Pataikos, the creator of the world, the sun, and moon, out of chaos (*ha*) or matter, to whom belong Sekhet, "the lioness," and Bast, Bubastis, lion-headed goddesses presiding over fire, and Nefer-Tum, his son, a god wearing a lotus on his head. Next in the cosmic order is Khnum—worshipped at Elephantine—the ram-headed god of the liquid element, who also created the matter of which the gods were made; and connected with him are the goddesses Heka the Frog, or primeval formation, Sati, or "sunbeam," and Anuka, alluding to the genesis of the cosmos. The Theban triad comprised Amen-ra, "the hidden" power of the "sun," the Jupiter; *Mut*, the "Mother" goddess of "Matter," the Juno; *Nit*, the "Shuttle," the Minerva; and Khons,

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"Force" or Hercules, a lunar type. A subordinate type of Ammon is Khem or Amsu, "the enshrined," who, as *Harnekht*, or Powerful Horus, unites beginning and end, or cause and effect.

A great variety of abstract principles and even animals and vegetables were, however, worshipped by the multitude, though the doctrine of one God was privately taught by the priests to a select few. To each deity an animal seems to have been held sacred, which was probably regarded as his symbolical representative. Bulls were consecrated to Osiris and cows to Athor; the sacred bull of Memphis, called Apis, being particularly venerated throughout Egypt. A hawk was the symbol of Re, the ibis of Thoth, the crocodile of Savak, and the cat of Phthah. Of the doctrines of the Egyptian religion little is accurately known. The existence of the spirit after death was believed, and a future state of rewards and punishments inculcated, in which the good dwelt with the gods, while the wicked were consigned to fiery torments amid perpetual darkness. It was believed that after the lapse of ages the spirit would return to the body, which was therefore carefully embalmed.

At the present day about nine tenths of the people in Egypt profess the Sunnite Mohammedan faith. About 750,000 are Christians and 25,000 are Hebrews. The Roman Catholics have two churches in Alexandria and two in Cairo. The Armenians also have a church and a bishop at Cairo. There is an American mission in both cities, but the natives are bigoted and exclusive and are not well disposed toward religious beliefs other than their own. See EMBALMING; MOHAMMEDANISM; IDOLATRY; PANTHEISM.

*Literature.*—See EGYPTIAN LITERATURE.

*Ancient Architecture.*—The monuments and traces of a past civilization found in Egypt are of two periods,—those built in the times of the Pharaohs, and those built during the sway of the Greek and Roman rulers of the country. Although the temples of the two periods differ considerably in plan and in other particulars, there is yet sound reason for believing that those built under the Greeks and Romans were constructed after designs, as they certainly occupy the sites of Pharaonic temples still more ancient than any now existing; that they were, in fact, mere restorations of temples built by the earlier Pharaohs.

The leading features of the now existing temples of the time of the Pharaohs are these: First, a gateway or pylon, flanked by two truncated pyramids. These occupy the entire width of the building, and form the entrance to a square court, surrounded by a portico supported by a double or single row of columns. Crossing this court the visitor passes through a second pylon into the inner court, which was likewise surrounded by a portico supported either by columns or by piers, against which were figures of the king. Beyond this second court it would appear the public were not admitted, for the spaces between the front row of columns or piers facing the gateway are occupied by a dwarf wall, which effectually barred entrance excepting at either one or three points where there were gates. This inner court led immediately into the largest chamber of the temple, called the Hall of Columns, the roof of which was

always supported by columns representing a grove of papyrus. The centre avenue was higher than the rest of the hall, and consisted usually of 12 columns, the capitals being imitated from the full-blown expanded papyrus, while the columns which sustained the lower roof were in the form of a bud of the same plant. To the Hall of Columns succeeded a series of smaller chambers, the roofs of which were generally supported by six or four columns, imitating the bud of the papyrus, either as a single plant or as several bound together; or else by square piers, or columns with 8, 12, or 16 faces. These apartments frequently surrounded a dark chamber—the most sacred in the temple—the holy of holies. Whether the roof of the portico which surrounded the court was supported by piers or columns, the structural arrangements were always precisely the same. There was first the pier or column, ordinarily made of several pieces of stone solidly united by mortar and wooden cramps; then came the architrave or frieze, of one block, stretching from column to column; and lastly, the blocks forming the cornice, concealing the ends of the roof stones which rested upon the architrave. The bulk of the column, in proportion to the weight it had to sustain, was extremely ample; and the pressure being always perpendicular, these ancient structures have come down to us with their roofs sound, while arched buildings of much less antiquity have been entirely ruined by the lateral pressure which that mode of construction exerts on the walls. The Egyptian gate was peculiarly simple. The lintel was always of one stone, and the door-posts also were very frequently of only one block, while each of the three portions had its appropriate decoration. Above the entrance was sculptured the winged globe or protecting divinity of entrances, with the names of the divinities to whom the temple was dedicated, and of the Pharaoh who built it. The door-posts also bore the name and title of the builder. The surface of each architectural feature was engraved with its particular ornament appropriately colored.

The temples built during the reigns of the Greek and Roman rulers may be thus described. First, the propylon, with its truncated pyramidal towers, which were sometimes adorned with narrow flags on tall poles; then a court surrounded on three sides with a colonnade. At the extremity of the court, and facing the gateway, was an elevated portico of six columns in line, and three or four deep. The uninitiated obviously were not permitted to enter beyond the court, for the columns of the first row of the portico are invariably joined by a dwarf wall, the only opening being between the centre intercolumniation, to which were attached the valves of the gate. To the portico succeeded a series of small chambers, the roofs of which were supported by four or by two columns. The centre chambers were lighted by small square openings in the roof, and those at the side by small openings in the walls; but in no example is there that kind of clerestory perforated with large openings, that occurs in the Hall of Columns of the Pharaonic temples. Besides the foregoing characteristics, there is an elaborate form of capital, representing the papyrus in three stages of growth, in one capital, or sometimes a collection of lotus flowers, or the full-blown papyrus alone; but in no instance do we find



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the pier with the attached figure, nor the single bud of the papyrus, nor that form of column which represents several buds of the plant joined together. The palm-tree capital, however, belongs to both periods.

Among the most remarkable structures erected by the ancient Egyptians are the great pyramids, erected to serve both as monuments and as tombs. Strong buildings containing one or more rooms were also erected as tombs, in which food and other articles were deposited for the use of the dead, the inner walls being embellished with inscriptions and representations, and statues of the dead being also placed in the interior. Tombs cut in the rock were also common. In connection with architecture should be mentioned the obelisks, the oldest known being erected by Userthesen I. Sphinxes, often forming avenues, were a common accessory of temples, the greatest being that known as *the Sphinx*, a colossal companion of the pyramids of Gizeh. See ARCHITECTURE; OBELISK; PYRAMIDS; SPHINX.

*Ancient Sculpture.*—In portrait sculpture the Egyptians attained extraordinary perfection at an early date, the skill with which they worked in hard stone, such as diorite and basalt, being surprising. Some of the early statues are of colossal size, but a higher style of art is shown in those of ordinary size, though a certain conventional treatment is always apparent. The most usual kind of mural sculpture, a kind peculiar to the Egyptians, is that known as hollow or sunk relief (*cavo-rilievo*). The general outline of the object intended to be represented is cut into the smooth surface of the stone, while at the same time the minor forms and rotundity are represented within the incised outline. By this contrivance the details of the sculptures are protected. Sometimes the outline is excessively deep, at others the surface of the figures is altogether much lower than the general surface of the wall, and in others the outline is but slightly incised with a corresponding flatness within. Wherever the Egyptians practised the true bas-relief the sculpture is almost invariably in very low relief. The back view of the human figure is never represented in the sculptures excepting in the case of an enemy, and then rarely; the figure is generally represented in profile, and there are but few attempts at delineating the front view of the foot or of the face; however, whether the face be represented in front or side view, a profile eye is never found. The figures of the king in battle-pieces, and of the landed proprietor in domestic scenes, are always on a much larger scale than the other actors in the piece. Statues and reliefs were always painted, and when wall painting is employed it is always as a substitute for sculpture. There is no proper perspective, and certain conventionalities of color are employed. The Egyptians are represented with red and yellow complexions, red ochre for the men and yellow for the women. The hair of the king is frequently painted blue, but that of ordinary men black. In representing the various nations with whom Egypt had intercourse, the artists seem to have endeavored to imitate the complexions peculiar to each. Ammon-Re, the chief divinity of Thebes, is always painted blue, and he is further distinguished by two high feathers which he wears in his cap. The inferior divinities are not uncommonly of the complexions of mortals. The

sky or heavens are invariably indicated by a strip of blue coming downward at the lower side of each extremity, and occasionally having upon it a row of five-pointed stars. Water, seas, and rivers are represented by zigzag lines of a blue or green color. Mountains have a yellow color, with red spots upon it. Egyptian art was at its highest during the period between dynasties four and six, and notwithstanding its defects it was superior to that of Nineveh and Babylon. See ART; SCULPTURE.

*Archæology.*—The attention of the world was drawn to Egypt as a rich field for scientific exploration in the early part of the 19th century. In 1799, M. Boussard, one of Bonaparte's captains, found a large block of black granite in the trenches of Fort Julien near Rosetta; hence the name Rosetta Stone. On this were the remains of three inscriptions in hieroglyphic, demotic, and Greek characters. The stone was given to the British Museum by George III.

Emanuel de Rougé of France was the first to translate whole Egyptian books and inscriptions. His influence was felt in France by such men as Mariette, Chabas, Deveria, Pierret, Maspero, and by Revillout, the great demotic scholar of France, and by Birch, Hincks, Lepage, and Renouf in England. The practical archæologists of the German school, notably Lepsius, Bunsen, and Brugsch, translated the texts in the Egyptian temples in their relation to history and religion. Ebers used his scientific researches in novels. The German school has devoted itself more to grammars and philology, while the French school has made history and archæology its special study since Emanuel de Rougé's death. To Auguste Mariette (Mariette Pasha) is due the discovery of the Serapeum of Memphis. He cleared the temples of Edfu, Karnak, Denderah and Abydos. He explored the Nile valley from Tanis to Napata, and his collections of antiquities were moved in 1889 to Gizeh from Boulak. The museum there is famous. In 1896, Col. G. E. Raun discovered the cap of the Sphinx at Gizeh, which had been missing for centuries.

After Mariette the work of excavation was carried on by Maspero, Grebaut, and De Morgan, the first of whom resumed his post as director-general of antiquities in 1899. There is an archæological mission in Cairo, founded in 1880 by Maspero, who placed at its head successively Lefebvre, Grebaut, and Bouriant. Students go every year to Egypt to excavate. The Egyptian Research Account under Petrie trains students as explorers. The Egyptian Exploration Fund was founded in 1883 by Sir Erasmus Wilson, Prof. R. Stuart Poole, and Miss Amelia B. Edwards, and its American branch at the close of that year by the Rev. Dr. William C. Winslow of Boston, who had spent several months of archæological research in Egypt and attended at the removal of the obelisk in Alexandria for Central Park, New York. Edouard Naville of Geneva, was the first agent sent out. In 1883 he cleared the site of Pithom near the land of Goshen. The work of Naville, Griffith, Gardner, and Newberry resulted in important discoveries at Nauceatis, Tanis, Bubastis, Tal-paug, Ahnas, Denderah, Deir-el-Bahari, and Tel-el-Amarna. See EXPLORATION; NUMISMATICS, etc.

*Recent Discoveries.*—The last few years have seen wonderful discoveries in Egypt, for the tombs of the kings at Abydos have been opened

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and the treasures which have been found place us face to face with the beginnings of history. Among the remarkable finds were a carved slate slab showing King Narmer smiting his enemy, an ebony table, a bar of gold, gold jewelry, including bracelets, and a royal sceptre. The oldest group of jewelry in the world is undoubtedly the four bracelets of the queen of King Zer (4715 B.C.), which was discovered with a portion of the mummy in a hole in a wall. This is 2,000 years earlier than any other jewelry thus far identified. The bracelets show a wonderful perfection in the soldering of the gold. The bracelets show the turning point in the development of Egyptian art, the finest bracelets being formed of alternate plaques of gold and turquoise, each surmounted with a royal hawk. The turquoise plaques have a more archaic and lumpy form of hawk than do the gold pieces, and show that during a comparatively short period, little more than half a century, rapid crystallization in art took place, and at the end of his reign the forms are practically identical with what continued for more than 4,000 years later. Dr. Flinders-Petrie considers that this is comparable to the sudden fixation of the final forms which is seen in Greek art, where an interval of only 40 years, between the time of the Persian war and the Parthenon, sufficed for the evolution from archaic work to the greatest perfection. Each of the royal tombs had two large tombstones, bearing the name of the king, and private tombs of all the court and domestics were placed around that of their royal master. They are nearly all built of brick, in most cases with a timber lining to the chamber sunk in the ground. They were originally roofed over with beams, matting and sand. They lie about a mile back from the Temple of Abydos and they were excavated by the Egyptian Exploration Fund.

An American archaeologist, Theodore M. Davies, has made one of the most interesting archaeological discoveries of recent years in excavating the tomb of one of the Pharaohs of the 18th dynasty, Thothmes IV. In this tomb was found the chariot in which Thothmes rode at Thebes. Like the other royal tombs Thothmes' tomb consists of a gallery cut in the heart of the mountain. After sloping downward for a considerable distance it is interrupted by a deep square well, on one of the walls of which is a band of paintings. On the farther side of the well the passage turns back, and finally opens into a large chamber, at the extreme end of which is a magnificent sarcophagus of granite covered with texts from 'The Book of the Dead.' On either side are smaller chambers, the floor of one of which was found to be covered with mummified loins of beef, legs of mutton, and trussed ducks and geese, offerings made to the dead king. Clay seals with the name of the Pharaoh had been attached to the doors of the chambers, and it is stated, these seals contain proof that the Egyptians of between 3,000 and 4,000 years ago had to some extent anticipated the invention of printing, the raised portions of the seals having been smeared with blue ink before being pressed on the clay. A great many of the objects in the tomb of Thothmes were found to be broken, and this was explained by a hieroglyphic inscription on one of the paintings which adorn the walls of the vestibule to the chamber in which the sarcophagus was found. This inscription states that the tomb was plun-

dered by robbers, but that it had been restored as far as possible to its original condition by Hor-em-heb, the reigning Pharaoh. The floor was covered with vases, dishes, symbols of life, and other objects of blue faience. Unfortunately, nearly all of them had been wantonly broken, though in some cases the breakage had been repaired in the time of Hor-em-heb. Equally interesting is a piece of textile fabric into which hieroglyphic characters of different colors have been woven with such wonderful skill as to present the appearance of painting on linen. It is, however, of course, the Pharaoh's chariot which is regarded as the great find. The body of it alone is preserved, but in a perfect condition. The wooden frame was first covered with papier mâché made from papyrus, and this again with stucco, which had been carved, both inside and out, into scenes from the battles fought by the Pharaoh in Syria. The art is of a very high order, every detail being exquisitely finished and the faces of the Syrians being clearly portraits taken from captives at Thebes. The chariot is, in fact, one of the finest specimens of art that have come down to us from antiquity. Along with the chariot was found the leather gauntlet with which the king protected his hand and wrist when using the bow or reins.

Recent excavations at Abydos have brought to light the royal tomb of Menes, of the first dynasty, in which was found a large globular vase of green glaze, with Menes' name inlaid in purple. Thus polychrome glazing is taken back thousands of years before it was previously known to exist. There are also several pieces of this age in the highest art of delicate ivory carving, especially the figure of an aged king, which, for subtlety of character, stands in the first rank of such work, and is comparable to the finest work of Greece and Italy. This fresh connection illustrates the trade chronology of the period. A camel's head modeled in pottery takes back its relation to Egypt some 4,000 years. Hitherto no trace of the camel appeared before Greek times. The ivory carving of a bear also extends the fauna of early Egypt.

*Bibliography.*—Bénédict, 'Egypte' (1900); Brugsch, 'Egypt under the Pharaohs' (1874); Bunsen, 'Ägyptens Stelle in der Weltgeschichte' (5 vols. 1845-57); Cameron, 'Egypt in the 19th Century' (1899); Champollion, 'L'Égypte sous les Pharaons' (1814); also 'Lettres' (1833); 'Monuments' (1843); Cottrell, English translation of Bunsen's works (1848-58); Darmesteter, 'The Mahdi' (1885); De Leon, 'Egypt Under the Khedive' (1882); Denon, 'Voyage dans la basse et la haute Égypte' (2 vols. 1802); also 'Description de l'Égypte' (26 vols. 1820-30); Dicey, 'England and Egypt' (1881); Ebers, 'Egypt Historical and Descriptive' (1877); Edwards, 'A Thousand Miles up the Nile' (1878); Erman, 'Life in Ancient Egypt' (1894); English Exploration Fund Reports, various dates; Hilmy, 'The Literature of Egypt' (1886); Lane, 'Modern Egyptians' (1871); Lane-Poole, 'Egypt' (1871); Lepsius, 'Denkmäler' (1874); Mahaffy, 'Empire of the Ptolemies' (1895); McCoan, 'Egypt as it Is' (1877); Mariette, 'Monuments of Upper Egypt' (1877); Maspero, 'Dawn of Civilization in Egypt' (1896), and 'Struggle of the Nations' (1896); Milner, 'England in Egypt' (1892); Penfield, 'Present-day Egypt' (1899); Perrot, 'History of Art in Ancient Egypt' (1883);

Petrie, 'History of Egypt' (1894); Rae, 'Egypt Today' (1892); Rawlinson, 'History of Ancient Egypt' (1881); Rosellini, 'Monumenti dell'Egitto' (1840); Royle, 'Egyptian Campaigns' (1886); Sharpe, 'History of Egypt from the Earliest Times to the Conquest of the Arabs' (1840); Steevens, 'Egypt in the 19th Century' (1899); Stuart, 'Egypt After the War' (1883); Uhlemann, 'Handbuch des gesammten Aegyptischen' (1858); Wallace, 'Egypt and the Egyptian Question' (1883); White, 'The Expansion of Egypt' (1899); Wiedemann, 'Religion of the Ancient Egyptians' (1897); Wilkinson, 'Manners and Customs of the Ancient Egyptians' (1879); Wilson, 'From Korti to Khartum' (1885); Wood, 'Egypt under the British' (1896); also the memoirs of the Egyptian Exploration Fund; Murray's and Baedeker's handbooks, etc.

**Egyptian Bean**, a name sometimes given to the bean-like fruits of the *Nelumbium speciosum*, or sacred lotus, found in China, India, Australia, but no longer on the Nile.

**Egyptian Blue**, a brilliant pigment consisting of the hydrated protoxide of copper mixed with a minute quantity of iron.

**Egyptian Literature.** The advance that has been made in recent years in the decipherment of the ancient writings of the world enables us to deal in a very matter-of-fact way with the Egyptian inscriptions. Their chief mysteries are solved, their philosophy is almost fathomed, their general nature is understood. The story they have to tell is seldom startling to the modern mind. The world was younger when they were written. The heart of man was given to devious ways then, as now and in the days of Solomon,—that we can affirm full well; but his mind was simpler; apart from knowledge of men and the conduct of affairs, the educated Egyptian had no more subtlety than a modern boy of 15, or an intelligent English rustic of a century ago.

To the Egyptologist by profession the inscriptions have a wonderful charm. The writing itself in its leading form is the most attractive that has ever been seen. Long rows of clever little pictures of things in heaven and earth compose the sentences; every sign is a plaything, every group a pretty puzzle, and at present, almost every phrase well understood brings a tiny addition to the sum of the world's knowledge. But these inscriptions, so rich in facts that concern the history of mankind and the progress of civilization, seldom possess any literary charm. If pretentious, as many of them are, they combine bald exaggeration with worn-out simile, in which ideas that may be poetical are heaped together in defiance of art. Such are the priestly laudations of the kings by whose favor the temples prospered. Take, for instance, the dating of a stela erected under Rameses II. on the route to the Nubian gold mines. It runs:—

On the fourth day of the first month of the season of winter, in the third year of the Majesty of Horus, the Strong Bull, beloved of the Goddess of Truth, lord of the vulture and of the ureus diadems, protecting Egypt and restraining the barbarians, the Golden Horus, rich in years, great in victories, King of Upper Egypt and King of Lower Egypt, *Mighty in Truth of Ra, Chosen of Ra, the son of Ra, Rameses Beloved of Amen*, granting life for ever and ever, beloved of Amen Ra lord of the "Throne of the Two Lands" in Apt Esut, appearing glorious on the throne of Horus

among the living from day to day even as his father Ra; the good god, lord of the South Land, Him of Edfu Horns bright of plumage, the beauteous sparrow-hawk of electrum that hath protected Egypt with his wing, making a shade for men, fortress of strength and of victory; he who came forth terrible from the womb to take to himself his strength, to extend his borders, to whose body color was given of the strength of Mentu; the god Horus and the god Set. There was exultation in heaven on the day of his birth; the gods said, "We have begotten him"; the goddesses said, "He came forth from us to rule the kingdom of Ra"; Amen spake, "I am he who hath made him, whereby I have set Truth in her place; the earth is established, heaven is well pleased, the gods are satisfied by reason of him." The Strong Bull against the vile Ethiopians, which uttereth his roaring against the land of the negroes while his hoofs trample the Troglodytes, his horn thrusteth at them; his spirit is mighty in Nubia and the terror of him reacheth to the land of the Kary; his name circulateth in all lands because of the victory which his arms have won; at his name gold cometh forth from the mountain as at the name of his father, the god Horus of the land of Baka; beloved is he in the Lands of the South even as Horus at Meama, the god of the Land of Buhen, King of Upper and Lower Egypt, *Mighty in Truth of Ra, son of Ra, of his body, Lord of Diadems, Rameses Beloved of Amen*, giving life for ever and ever like his father Ra, day by day. [Revised from the German translation of Professor Erman.]

As Prof. Erman has pointed out, the courtly scribe was most successful when taking his similes straight from nature, as in the following description, also of Rameses II.:—

A victorious lion putting forth its claws while roaring loudly and uttering its voice in the Valley of the Gazelles. . . . A jackal swift of foot seeking what it may find, going round the circuit of the land in one instant, . . . his mighty will seizeth on his enemies like a flame catching the ki-ki plant with the storm behind it, like the strong flame which hath tasted the fire, destroying, until everything that is in it becometh ashes; a storm howling terribly on the sea, its waves like mountains, none can enter it, every one that is in it is engulfed in Duat.

Here and there among the hieroglyphic inscriptions are found memorials of the dead, in which the praises of the deceased are neatly strung together and balanced like beads in a necklace, and passages occur of picturesque narrative worthy to rank as literature of the olden time. We may quote in this connection from the biographical epitaph of Ameny, who was governor of a province in middle Egypt for 25 years during the long reign of Usertesen I. (about 2716 B.C.). This inscription not only recounts the achievements of Ameny and the royal favor which was shown him, but also tells us in detail of the capacity, goodness, charm, discretion, and insight by which he attached to himself the love and respect of the whole court, and of the people over whom he ruled and for whose well-being he cared. Ameny says:—

I was a possessor of favor, abounding in love, a ruler who loved his city. Moreover I passed years as ruler in the Oryx nome. All the works of the house of the King came into my hand. Behold, the superintendent of the gangs of the domains of the herdsmen of the Oryx nome gave me 3,000 bulls of their draught stock. I was praised for it in the house of the King each year of stock-taking. I rendered all their works to the King's house: there were no arrears to me in any of his offices.

The entire Oryx nome served me in numerous attendances. There was not the daughter of a poor man that I wronged, nor a widow that I oppressed. There was not a farmer that I chastised, not a herdsman whom I drove away, not a foreman of five whose men I took away for the works. There was not a pauper around me, there was not a hungry man of my time. When there came years of famine, I arose and ploughed all the fields of the Oryx nome to its boundary south and north, giving life to its inhabitants, making its provisions. There was not a hungry man in it. I gave to the widow as to her that possessed a husband, and I favored not the elder above the younger in all that I gave. Thereafter great rises of

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the Nile took place, producing wheat and barley, and producing all things abundantly, but I did not exact the arrears of farming.

Elsewhere in his tomb there are long lists of the virtues of Amenemhat, and from these the following may be selected both on account of picturesqueness of expression and the appreciation of fine character which they display:—

Superintendent of all things which heaven gives and earth produces, overseer of horns, hoofs, feathers, and shells. . . . Master of the art of causing writing to speak. . . . Caressing of heart to all people, making to prosper the timid man, hospitable to all, escorting [travelers] up and down the river. . . . Knowing how to aid, arriving at time of need; free of planning evil, without greediness in his body, speaking words of truth. . . . Unique as a mighty hunter, the abode of the heart of the King. . . . Speaking the right when he judges between suitors, clear of speaking fraud, knowing how to proceed in the council of the elders, finding the knot in the skein. . . . Great of favors in the house of the King, contenting the heart on the day of making division, careful of his goings to his equals, gaining reverence on the day of weighing words, beloved of the officials of the palace.

The cursive forms of writing—hieratic from the earliest times, demotic in the latest—were those in which records were committed to papyrus. This material has preserved to us documents of every kind, from letters and ledgers to works of religion and philosophy. To these, again, "literature" is a term rarely to be applied; yet the tales and poetry occasionally met with on papyri are perhaps the most pleasing of all the productions of the Egyptian scribe.

It must be confessed that the knowledge of writing in Egypt led to a kind of primitive pedantry, and a taste for unnatural and to us childish formality; the free play and naïveté of the story-teller is too often choked, and the art of literary finish was little understood. Simplicity and truth to nature alone gave lasting charm, for though adornment was often attempted, their rude arts of literary embellishment were seldom otherwise than clumsily employed.

A word should be said about the strange condition in which most of the literary texts have come down to us. It is rarely that monumental inscriptions contain serious blunders of orthography; the peculiarities of late archaistic inscriptions which sometimes produce a kind of "dog Egyptian" can hardly be considered as blunders, for the scribe knew what meaning he intended to convey. But it is otherwise with copies of literary works on papyrus. Sometimes these were the productions of schoolboys copying from dictation as an exercise in the writing school, and the blank edges of these papyri are often decorated with essays at executing the more difficult signs. The master of the school would seem not to have cared what nonsense was produced by the misunderstanding of his dictation, so long as the signs were well formed. The composition of new works on the model of the old, and the accurate understanding of the ancient works, were taught in a very different school, and few indeed attained to skill in them. The boys turned out of the writing school would read and write a little; the clever ones would keep accounts, write letters, make out reports as clerks in the government service, and might ultimately acquire considerable proficiency in this kind of work. Apparently men of the official class sometimes amused themselves with puzzling over an ill written copy of some ancient tale, and with trying to copy portions of it.

The work, however, was beyond them; they were attracted by it, they revered the compilations of an elder age and those which were "written by the finger of Thoth himself"; but the science of language was unborn, and there was little or no systematic instruction given in the principles of the ancient grammar and vocabulary. Those who desired to attain eminence in scholarship after they had passed through the writing school had to go to Heliopolis, Hermopolis, or wherever the principal university of the time might be, and there sit at the feet of priestly professors; who we fancy were revered as demigods, and who in mysterious fashion and with niggardly hand imparted scraps of knowledge to their eager pupils. Those endowed with special talents might after almost lifelong study become proficient in the ancient language. Would that we might one day discover the hoard of rolls of such a copyist and writer!

There must have been a large class of hack-copyists practised in forming characters both uncial and cursive. Sometimes their copies of religious works are models of deft writing, the embellishments of artist and colorist being added to those of the calligrapher; the magnificent rolls of the 'Book of the Dead' in the British Museum and elsewhere are the admiration of all beholders. Such manuscripts satisfy the eye, and apparently neither the multitude in Egypt nor even the priestly royal undertakers questioned their efficacy in the tomb. Yet are they very apples of Sodom to the hieroglyphic scholar, fair without but ashes within. On comparing different copies of the same text, he sees in almost every line omissions, perversions, corruptions, until he turns away baffled and disgusted. Only here and there is the text practically certain, and even then there are probably grammatical blunders in every copy. Nor is it only in the later papyri that these blunders are met with. The hieroglyphic system of writing, especially in its cursive forms, lends itself very readily to perversion by ignorant and inattentive copyists; and even monumental inscriptions, so long as they are mere copies, are usually corrupted. The most ridiculous perversions of all date from the Ramesside epoch when the dim past had lost its charm, for the glories of the 18th dynasty were still fresh, while new impulses and foreign influence had broken down adherence to tradition and isolation.

In the 8th century B.C. the new and the old were definitely parted, to the advantage of each. On the one hand the transactions of ordinary life were more easily registered in the cursive demotic script, while on the other the sacred writings were more thoroughly investigated and brought into order by the priests. Hence, in spite of absurdities that had irremediably crept in, the archaistic texts copied in the 26th dynasty are more intelligible than the same class of work in the 19th and 20th dynasties.

In reading translations from Egyptian, it must be remembered that uncertainty still remains concerning the meanings of multitudes of words and phrases. Every year witnesses a great advance in accuracy of rendering; but the translation even of an easy text still requires here and there some close and careful guesswork to supply the connecting links of passages or words that are thoroughly understood, or the resort to some conventional rendering that has

become current for certain ill understood but frequently recurring phrases. The Egyptologist is now to a great extent himself aware whether the ground on which he is treading is firm or treacherous, and it seems desirable to make a rule of either giving the public only what can be warranted as sound translation, or else of warning them where accuracy is doubtful. A few years ago such a course would have curtailed the area for selection to a few of the simplest stories and historical inscriptions; but now we can range over almost the whole field of Egyptian writing, and gather from any part of it warranted samples to set before the reading public. The labor, however, involved in producing satisfactory translations for publication, not mere hasty readings which may give something of the sense, is very great; and at present few texts have been well rendered.

We may now sketch briefly the history of Egyptian literature, dealing with the subject in periods:

1. *The Ancient Kingdom, About 4400 B.C.—3000 B.C.*—The earliest historic period—from the First Dynasty to the Third, about 3766 B.C.—has left no inscriptions to any extent. Some portions of the 'Book of the Dead' (q.v.) profess to date from these or earlier times, and probably much of the religious literature is of extremely ancient origin. The first book of 'Proverbs' in the Prisse Papyrus is attributed by its writer to the end of the Third Dynasty (about 3766 B.C.). From the Fourth Dynasty to the end of the Sixth (3100 B.C.) the number of the inscriptions increases; tablets set up to the kings of the Fourth Dynasty in memory of warlike raids are found in the peninsula of Sinai, and funerary inscriptions abound. The pyramids raised at the end of the Fifth and during the Sixth Dynasties are found to contain interminable religious inscriptions, forming almost complete rituals for the deceased kings. Prof. Maspero, who has published these texts, states that they "contain much verbiage, many pious platitudes, many obscure allusions to the affairs of the other world, and among all this rubbish some passages full of movement and wild energy, in which poetical inspiration and religious emotion are still discernible through the veil of mythological expressions." Of the funerary and biographical inscriptions the most remarkable is that of Una, an official of King Mer-en-ra (Sixth Dynasty).

Another, later but hardly less important, is on the façade of the tomb of Hehrhuf, at Aswan, and recounts the expeditions into Ethiopia and the southern oasis which this resourceful man carried through successfully. In Hehrhuf's later life he delighted a boy king of Egypt by bringing back for him from one of his raids a grotesque dwarf dancer of exceptional skill; the young Pharaoh sent him a long letter on the subject, which was copied in full on the tomb as an addition to the other records there. It is to the Fifth Dynasty also that the second collection of 'Proverbs' in the Prisse Papyrus is dated. The Seventh and Eighth Dynasties have left us practically no records of any kind.

2. *The Middle Kingdom, 3000—1600 B.C.*—The Middle Kingdom from the Ninth to the Seventeenth Dynasty, shows a great literary development. Historical records of some length

are not uncommon. The funerary inscriptions descriptive of character and achievement are often remarkable.

Many papyri of this period have survived: the Prisse Papyrus of 'Proverbs,' a papyrus discovered by Mr. Flinders Petrie with the 'Hymn to Usertesen III.,' papyri at Berlin containing a dialogue between a man and his soul, the 'Story of Sanehat,' the 'Story of the Sekhti,' and a very remarkable fragment of another story; besides the 'Westcar Papyrus of Tales' and at St. Petersburg the 'Shipwrecked Sailor.' The productions of this period were copied in later times; the royal 'Teaching of Amenemhat' and the worldly 'Teaching of Dauf' as to the desirability of a scribe's career above any other trade or profession, exist only in late copies. Portions of the 'Book of the Dead' are found inscribed on tombs and sarcophagi.

3. *The New Kingdom, etc.*—From the New Kingdom, 1600—700 B.C., we have the 'Maxims of Any,' spoken to his son Khonsu Hetep, numerous hymns to the gods, including that of King Akhenaten (Amenhotep IV.) to the disk of the sun, and hymns to Amen Ra. Inscriptions of every kind, historical, mythological, and funereal abound. The historical inscription of Piankhi is of very late date. On papyri the stories of 'The Two Brothers,' of 'The Taking of Joppa,' and of the 'Doomed Prince.'

From the Saite period (Twenty-sixth Dynasty, 600 B.C.) and later, there is little worthy of record in hieroglyphics; the inscriptions follow ancient models. In demotic we have the 'Story of Setna,' a papyrus of moralities, a chronicle somewhat falsified, a harper's song, a philosophical dialogue between a cat and a jackal, and others.

Here we might end. Greek authors in Egypt were many; some were native, some of foreign birth or extraction, but they all belong to a different world from the ancient Egyptian. With the adaptation of the Greek alphabet to the spelling of the native dialects, Egyptian came again to the front in Coptic, the language of Christian Egypt. Coptic literature, if such it may be called, was almost entirely produced in Egyptian monasteries and intended for edification. Let us hope that it served its end in its day. To us the dull, extravagant, and fantastic 'Acts of the Saints,' of which its original works chiefly consist, are tedious and ridiculous except for the linguist or the church historian. They certainly display the adjustment of the ancient Egyptian mind to new conditions of life and belief; but the introduction of Christianity forms a fitting boundary to our sketch. See EGYPT; HIEROGLYPHICS.

SAMUEL AUGUSTUS BINION,

*Author of 'Ancient Egypt or Mizraim.'*

**Egyptian Sudan.** See SUDAN.

**Egyptian Vulture** (*Neophron percnopterus*), a well-known bird which frequents both shores of the Mediterranean, southern India, and, during the winter, south Africa. It is the scavenger of Egyptian villages, collecting in numbers where carrion or garbage is deposited, but feeding also on frogs, lizards, and small mammals found in cultivated fields. The birds usually go in pairs, however, and addict themselves to particular localities, being only drawn together in numbers by abundance of their favorite food. The name, as also that of Pharaoh's hen, is



given because of the frequent representation of this bird in Egyptian sculpture. See VULTURE.

**Egyptology**, the science of Egyptian antiquities. See EGYPT.

**Ehninger**, ā'n'ing-ér, **John Whetton**, American artist: b. New York 22 July 1827; d. Saratoga, N. Y., 22 Jan. 1889. He was graduated at Columbia College, studied two years under Comure in Paris and later at Düsseldorf, and served as staff-artist for an illustrated London journal. He was elected a National Academician in 1860. His works include landscape and figure subjects, among them being: 'Peter Stuyvesant' (1850); 'Eight illustrations of Miles Standish' (1858); 'Autumnal Landscape' (1867); 'Twilight from the Bridge of Pau, Basses-Pyrenees' (1878); 'Subject for Thanksgiving' (1879); 'Lady of the Manor' (1882); 'The Old, Old Story' (1884).

**Ehrenberg**, ā'rën-bërg, **Christian Gottfried**, German scientist: b. Delitzsch 19 April 1793; d. Berlin 27 June 1876. After studying theology, medicine, and natural history at Leipzig and Berlin, he joined in 1820 an expedition to Palestine, Egypt, and Abyssinia, returning to Berlin in 1825. In 1829 he accompanied Humboldt to the Ural and Altai ranges and to central Siberia. His great work on 'Infusoria' ('Die Infusionstierchen als vollkommene Organismen') appeared in 1838, and was at once recognized as the highest authority on the subject. It was followed in 1854 by his 'Microgeology.' Ehrenberg's work gave an enormous impetus to the study of microscopic organisms. He was the first to show that the phosphorescence of the sea is due to the presence of hosts of animalcules. Consult 'Life,' by Lane (1895).

**Ehrle**, Francis, German Catholic scholar: b. Isny, Württemberg, 17 Oct. 1845. He was educated at the Jesuit College, Munster, Westphalia, and after several years in mission work was transferred to Rome, where he devoted himself to historical studies. His 'History of the Church and its Literature in the Middle Ages' (in German) is based on extensive researches in the archives of Germany, England, Spain, and Italy. It is on this work that his reputation largely rests; but he has further written a Latin history of the Papal library from 1200 to 1417, and (with Stevenson) a history of the Vatican. He was made prefect of the Pontifical Library, and placed in charge of the Papal exhibit at the Louisiana Purchase Exposition, Saint Louis.

**Eibenstock**, i'bën-stök, Germany, town in the southeast of Saxony, near the Mulde, with important manufactures of lace. The tin mines nearby have been worked for about eight centuries. It is connected by rail with Chemnitz, about 40 miles distant. Pop. 7,500.

**Eichberg**, i'h'bërg, **Julius**, American composer: b. Düsseldorf, 13 June 1824; d. Boston, Mass., 19 Jan. 1893. After being professor in the Conservatoire at Geneva, he removed to New York in 1857, and in 1859 went to Boston, where he was director of the orchestra at the Boston Museum for seven years. In 1867 he established the Boston Conservatory of Music, of which he was at the head till his death. Four of his operettas are well known: 'The Doctor of Alcantara'; 'The Rose of Tyrol'; 'The Two Cadis'; and 'A Night in Rome.'

**Eichendorff**, i'hën-dórf, **Baron Joseph von**, German poet: b. Castle of Lubowitz, Silesia, 10 March 1788; d. Neisse 26 Nov. 1857. He was one of the most gifted and original romantic lyricists of Germany. His principal works are: 'Presage and Presence'; 'War to the Philistines,' a dramatic story; 'The Life of a Good-for-Nothing,' idealizing vagabondage; the tragedies 'Ezzelin von Romano,' 'The Last Hero of Marienburg'; and other plays, and a number of histories of German literature, including 'The Ethical and Religious Meaning of the New Romantic Poetry in Germany' (1847); 'German Romance of the Eighteenth Century in Relation to Christianity' (1851); 'History of German Poetry' (1857).

**Eichens**, Friedrich Eduard, frëd'rîh ed'oo-ärd i'hënz, German engraver: b. Berlin 27 May 1804; d. 5 May 1877. He studied in Berlin, Paris, and Parma, and returning to Berlin in 1832 was made a member of the Academy. He left many works, including: 'Vision of Ezekiel' after Raphael; 'Magdalen' after Dominichino; 'Christ in the Tomb' after H. Carrache; 'Prince Radziwill on His Deathbed' after M. Hanzel; and some engravings after Kaeilback.

**Eichens**, Philip Herman, German lithographer and engraver: b. Berlin 13 Sept. 1812; d. 1886. He was a brother of F. E. Eichens (q.v.). He studied under Henzel at the Berlin Academy, and among his engravings are: 'La Joconde'; and 'Return of the Pirates of Meyerkeim.' He received medals for his lithographs in Paris 1842, 1859, 1861, and 1863.

**Eichhoff**, Friedrich Gustav, frëd'rîh goos'täf i'h'höf, French philologist: b. Havre 17 Aug. 1799; d. Paris 10 May 1875. In 1842 he became professor of foreign languages at Lyons and in 1851 inspector-general of the University of Paris. He wrote a 'General Indo-European Grammar' (1867); etc.

**Eichhorn**, Johann Gottfried, yō'hän göt'frëd i'h'hörn, German theologian and Orientalist: b. Dörrenzimmern 16 Oct. 1752; d. Göttingen 25 June 1827. In 1775 he became professor of Oriental languages at Jena, and in 1788 at Göttingen. He edited a 'Repertory of Biblical and Oriental Literature' (1777-86); 'Universal Library of Biblical Literature' (1787-1803); and wrote 'Historico-Critical Introductions' to the Old and to the New Testament, and to the Apocryphal Books of the Old Testament; a 'Latin Commentary on the Apocalypse'; etc.

**Eichrodt**, Ludwig, lood'vîg, German poet: b. Durlach, Baden, 2 Feb. 1827; d. Lahr 2 Feb. 1892. He studied at Heidelberg and Freiburg and published in 1848 in 'Fliegende Blätter' his comic songs, 'Wanderlust,' which had great popularity. Among his works are: 'Poems of All Humors' (1855); 'Life and Love' (1856); 'The Chateau of the Voges' (1858); 'Hortus Deliciarum' (1875); 'Gold' (1880).

**Eichstätt**, i'h'stët, or **Eichstädt**, Middle Franconia, Bavaria, an old town in a deep valley of the Altmühl, 67 miles north-northwest of Munich. Its principal edifice is a fine Gothic cathedral, founded in 1259. Pop. 7,489.

**Eider**, a river of Prussia, in Schleswig-Holstein, which rises about 12 miles from Kiel, flows generally northwest, and after a course of 112 miles, of which 69 are navigable, empties into the North Sea at Tönning.



## EIDER DUCK—EIGHT-HOUR DAY

**Eider Duck**, a bird of the sub-family *Fuliginæ*, or sea ducks, genus *Somateria*, distinguished by the peculiar form and feathering of the bill, and closely allied to the scoter ducks. The several species are confined to the northern regions. The American eider (*S. dresseri*) and the European eider (*S. mollissima*) are closely similar species which breed on solitary rocky shores and islands from Maine and the Farne Islands respectively, northward, the former species wintering as far south as the Delaware River. They are most abundant in Labrador, Newfoundland, Greenland, Iceland, and Norway, where they are stringently protected by law. Both species breed gregariously and in particular spots their nests are so abundant that a person can scarcely walk without treading on them. Their nests are usually formed of grass, dry sea-weed, etc., lined with a quantity of down which the female plucks from her own breast. In this soft bed she lays five eggs, which she covers over with a layer of down; then the natives, who watch her operations, take away both the eggs and the down, and this removal is repeated as often as she lays until the close of the season, when the last lot of eggs is allowed to hatch and the down removed from the nest only after the young have left. The drake does not, as is often stated, furnish any of the down. One female generally furnishes a few ounces of down. This down, from its superior warmth, lightness, and elasticity, is preferred by the luxurious to every other article for beds and coverlets; and, from the great demand for it, those districts in Norway, Greenland, and Iceland where these birds abound are regarded as the most valuable property and are guarded with the greatest vigilance. Proprietors endeavor to attract them by supplying artificial nests and otherwise, and when they settle in an island off shore, cattle and herdsmen are removed to allow them to breed undisturbed. The down from dead birds is little valued, having lost its elasticity.

The length of the eider duck is about 2 feet 3 inches, extent of the wings 3 feet, weight from 6 to 7 pounds; the head is large and the bill of singular structure, being 3 inches in length, forked at the base of the upper mandible in a remarkable manner, running high up on the forehead, and having the feathers on each side descending nearly to the nostrils; the whole of the bill is of a dull, yellowish horn color, somewhat dusky in the middle. The male is black beneath, head and back white, with a black crown. The female is reddish drab, spotted with black, with two white bands across the wings. Eiders associate in flocks, diving to great depths for shell-fish, which constitute their principal food. They live much on the water, retiring to the shores to rest, particularly on the appearance of an approaching storm. Their flesh is eaten, but tastes strongly of fish. The eggs, however, are esteemed. These and the down are both frequently obtained at the hazard of life by people let down by ropes from craggy steep.

Other species are the Pacific eider (*S. v-nigra*, and the remarkable king eider (*S. spectabilis*) of high Arctic regions. The now extinct Labrador duck (q.v.) is closely related.

**Eidograph**, ɪ'dō-graf, an instrument for copying designs invented by Prof. Wallace to re-

duce or enlarge them in any proportion, within certain limits; a form of pantograph.

**Eidoscope**, ɪ'dō-skōp, an instrument on the principle of the kaleidoscope, which produces an infinite variety of geometrical figures by the independent revolution of two perforated metallic disks. It may be employed with the magic lantern, when rapidly rotated, causing flashing rays of light, forming singular combinations to appear upon the screen. Various colored glass disks may be used, producing striking combinations of color.

**Eifel**, ɪ'fəl, **The**, a barren and bleak plateau of Rhenish Prussia, between the Rhine, Moselle, and Roer rivers, showing extensive traces of volcanic action. Its surface is diversified by crater-like depressions and volcanic peaks and ridges.

**Eiffel**, ā-fəl or ɪ'fəl, **Alexandre Gustave**, French engineer: b. Dijon 15 Dec. 1832. In 1858 he was intrusted with the construction of the large iron bridge over the Garonne at Bordeaux, and was one of the first to introduce caissons worked with compressed air. The bridge over the Douro at Oporto, the great viaduct of Garabit, in Cantal, and that over the Tardes, near Montluçon, and the gigantic locks designed and partly prepared for the Panama Canal are among later triumphs of his engineering skill; while in the huge framework erected for Bartholdi's 'Statue of Liberty' may be seen the germ of the idea which afterward assumed the form of the colossal iron structure (1887-9) on the Champs-de-Mars in Paris, with which his name is identified. See **EFFEL TOWER**.

**Eiffel Tower**, **The**, a notable structure in Paris. The plans for the exposition of 1889 included a monstrous iron tower, to be raised on the Champs-de-Mars, 1,000 feet high. The designer, Gustave Eiffel, constructed it of iron lattice-work, with three elevators giving access to the summit. The uses of so stupendous an undertaking are many, and it became one of the chief permanent ornaments of the city. Its importance from a meteorological point of view cannot be overestimated, the tower enabling meteorologists to study the decrease of temperature at different heights, to observe the variations of winds, and to find out the quantity of rain that falls at different heights, and the density of the clouds.

**Eigenmann**, ɪ'gen-mən, **Carl H.**, American zoologist: b. Flehingen, Germany, 1863. He was graduated at Indiana University in 1886 and studied at Harvard 1887-8. Between 1888 and 1892 he continued his scientific investigations in San Diego Biological Laboratory, the Woods Holl Marine Stations, and in the explorations undertaken for the British Museum in California, Oregon, Idaho, Montana, Dakota, and western Canada. He was appointed professor of zoology in Indiana University in 1891 and in 1895 founded and assumed the direction of the Biological Station of Indiana University. He has contributed more than a hundred papers to the proceedings of scientific societies and to scientific journals.

**Eigg**. See **Egg**.

**Eight-hour Day**. In the struggle for the shortest hours of labor compatible with the highest efficiency, begun in Great Britain early in the

## EIGHT-HOUR LAW — EILETHYIA

19th century, the first great landmark was the Ten Hours' Bill of 1847, enforcing in all trades what had come about in many. But the golden ideal since 1824 (announced as such by Robert Owen in 1817) has been eight hours; possibly in remembrance that such was the rule in mediæval England; partly perhaps from the tempting threefold division of the day into equal parts, as in the rhyme "Eight hours for work, eight hours for play, eight hours for sleep, eight 'bob' a day." The eight-hour day was won in Australia in 1858. The movement on the Continent dates from the foundation of the "International" in 1864, and as a world-demand of the social reformers, from the Paris Trades-Union Congress of 1883. In the United States, till recently the subject was left to the States and to private contests, the government aiding by making short hours in its own works. In 1840 President Van Buren reduced the working day in the government navy yards to 10 hours. The first State 10-hour law, for textile workers only, was of 1849, in Pennsylvania. The first Massachusetts law was in 1874, and was due largely to the "Knights of St. Crispin." But the eight-hour movement had long before become general: in 1866 the demand was formulated at a general workingmen's congress at Baltimore, and at other meetings; and the National Labor Union was organized to secure an eight-hour day. A six weeks' strike in New England and New York, April-May 1866, attempted to secure it, but failed. In 1867 Connecticut and Illinois passed laws making eight hours a legal day "unless otherwise agreed." Pennsylvania followed in 1868 and New York in 1870. On 24 June 1869 the United States enacted an eight-hour day for its establishments; but the managers reduced wages correspondingly, allowing those who wished to work 10 hours at the old wages, which aroused such wrath that the President revoked the order. All these laws were rendered nugatory by the contracting-out clauses. In 1872 eight-hour leagues were formed in various places, and in Connecticut and New York a mass of strikes among the wood-working trades won this goal for a while; but the great depression from 1873 on prevented pressing such questions. Since 1880 several States have enacted the eight-hour law under the above conditions. But the first great concerted effort for eight hours was in 1886, when 200,000 workmen went on strike; it was at an eight-hour meeting in Haymarket Square, Chicago, that the anarchist bomb was thrown. A general strike was announced for this object in 1890, but was only partially successful, several hundred thousand workmen struck, and many employers yielded, but soon advanced the hours. The first really efficient national law was of 1 Aug. 1892, enforcing eight hours upon all laborers, mechanics, or contractors in the District of Columbia, under pain of fine and imprisonment. The short-hours' movement was first begun to protect women and children, the men sharing incidentally. It may be added that the practical results of the system are almost universally favorable. See Webb and Cox, 'The Eight-Hour Day' (1891); Rae, 'Eight Hours for Work' (1894).

**Eight-hour Law**, an act adopted in 1868 by the United States Congress, providing that in all government employment eight hours shall constitute a day's work. It originated in the

agitation which had begun in England in 1833 by the proposition of eight hours as a legitimate working day. The agitation spread itself among the industrial classes throughout the civilized world, and first bore fruit in Australia in 1856, where it was adopted by several trades. The National Labor Union of the United States demanded it in 1866, and it came into effect in the government navy yards in 1869, and shortly afterward in all departments of government work. Its universal adoption, however, is still unrealized, and it is the source of persistent agitation among the labor organizations and parties throughout the United States, the British Empire, and on the continent of Europe. Consult: Rae, 'Eight Hours for Work' (1894).

**Eighth Nerve.** See AUDITORY NERVE.

**Eikon Basilike**, *ī'kōn ba-sīl'ī-kē* (Gr. "the royal image"), a work the full title of which is *Εἰκὼν Βασιλική*: 'The Portraiture of His Sacred Majesty in His Solitudes and Sufferings.' It was published 9 Feb. 1649, 10 days after the execution of Charles I., and within 12 months ran through 50 editions in various languages. It professes to be Charles' own composition in the form of a diary. It is written in an affectedly dignified strain, and contains numerous assertions of love for his misguided and ungrateful people. At the Restoration, Gauden, afterward bishop of Worcester, laid claim to the authorship, and a memorandum in the copy of the Earl of Anglesea, lord privy-seal under Charles II., affirms that claim with the authority of Charles II. and the Duke of York. Milton's answer to it, 'Eikonoklastes' (that is "image-breaker") appeared the same year by order of Parliament. Gauden professed to have begun the work in or about the year 1647, and to have submitted a MS. copy of it to the king. On the other hand, those who maintain that the work was by Charles, assert that he had written the first six of its 28 chapters before the battle of Naseby (1645). The question is one of much complexity. Historians generally, from Lingard to Green, have pronounced against Charles; while some of those who have sifted his claims are in his favor. See GAUDEN, JOHN.

**Bibliography.**—Almack, 'Bibliography of the King's Book' (1896); Doble, in the 'Academy' (1883); Scott (E. J. L.) Comments in Edition of the 'Work' (1880); Wordsworth (Christopher), 'Who Wrote Icon Basilike?' (1824-5); 'King Charles I., the Author of Icon Basilike' (1828).

**Eildon** (*ēl'dōn*) Hills, three peaks belonging to a single mass, south of Melrose, in Roxburghshire, Scotland. The highest attains an elevation of 1,385 feet above sea-level, and all command a splendid prospect and are rich in historic and legendary associations.

**Eilenburg**, *ī'lēn-boorg*, Germany, town of Prussian Saxony, in the government of Merseburg, mainly situated on an island of the Mulde, 14 miles northwest of Leipsic. It has manufactures of calico, woolen cloth, and chemicals. Pop. (1900) 15,147.

**Eilethy'ia** (hieroglyph. *Nekheh*; city of Lucina, now called EL-KĀN), a city of ancient Egypt, situated on the right bank of the Nile, a little below Edfu. The present ruins consist of the remains of small temples dedicated by Ramesses III. to Ra; a Ptolemaic temple dedicated

to the eponymous goddess Lucina by Phiscon or Euergetes II., with additions by Ptolemy Alexander I. and the elder Cleopatra; and an ancient temple dedicated by Amenophis III. to the local deities. The names of other monarchs are also found in the ruins; but the most interesting and important remains are the rock-tombs, some as early as the 13th dynasty, excavated in the hills. That of Aahmes, the "captain of the sailors," records his services in the wars of the early monarchs of the 18th dynasty against the Hyksos or Shepherds, and other Asiatic and Nigritic races. Another, that of Pahir, is decorated with rich and elaborate paintings, representing the pursuits of agriculture, fowling, fishing, etc. The city was an outpost against the southern tribes, and its fort, a large enclosure of crude brick, was of importance as early as the Shepherd war. The goddess Suben (Eilethia or Lucina) was a special protectress of Upper Egypt. Consult: Brugsch, 'Reiseberichte,' and 'Egypt Under the Pharaohs'; Wilkinson, 'Ancient Egyptians'; Mariette, 'Ancient Egyptian History.'

**Eimbeck**, im'bĕk, **William**, American geodesist: b. Brunswick, Germany, 29 Jan. 1841. He was for two years professor of mechanics and engineering, Washington University, and a member of the government solar eclipse expeditions to Illinois 1869 and to Italy 1870. He has been a Fellow of the American Association for the Advancement of Science since 1879, and is the inventor of the invariable reversible pendulum and the duplex base apparatus of coast and geodetic survey. His chief work has been in connection with the western divisions of the 39th parallel triangulation across the continent.

**Eimeo**, i'mĕ-ō, one of the Society Islands, in the Pacific Ocean, about 20 miles west-northwest of Tahiti, the principal member of the group; area 51 square miles. It consists of deep valleys and abrupt hills—the former well cultivated, and the latter heavily timbered. Here Christianity was first introduced in Polynesia; and here the South Sea College of the London Missionary Society was established. Most of the natives are Protestants. Pop. 1,500.

**Einbeck**, in'bĕk, or **Eimbeck**, Germany, town of Prussia, in the province of Hanover, on the Ilme, near its junction with the Leine, 40 miles south of Hanover. It carries on several industries, and the formerly celebrated Eimbecker bier ("bock" beer) is still made here. Einbeck was a place of importance in the 15th century. It was a member of the Smalkaldic League, and it figured prominently in the Thirty Years' and the Seven Years' wars. There are still remains of its old walls and towers. Pop. 8,436.

**Einhard**. See EGINHARD.

**Einhorn**, in'hörn, **David**, American rabbi: b. Dispeck, Bavaria, 10 Nov. 1809; d. New York 2 Nov. 1879. His first rabbinical position was at Hopstadten, Bavaria, and shortly afterward he became chief rabbi of the grand duchy of Mecklenburg-Schwerin. In 1851 he was called to Pesth, but his progressive tendencies aroused sharp opposition and his temple was closed by order of the government. In 1855 he was invited to become rabbi of the Har Sinai Congregation, of Baltimore, Md. His activity was now to be rapidly developed, for he issued his prayer-

book, which was warmly received by many reformed Jewish congregations, and he began the publication of a scholarly monthly magazine in German, entitled 'Sinai,' in the interests of advanced reform. His vigorous onslaughts on slavery in 1861 led to his removal from Baltimore to Philadelphia, there becoming rabbi of the Keneseth Israel Temple, and publishing his catechism. In 1866 he was elected rabbi of the Adath Teshurun Temple in New York, where he continued a zealous, impassioned and scholarly advocate of reform and the leader of the then radical school, until his retirement in July 1879.

**Einsiedeln**, in'zē dĕln (place of the solitaires or hermits), a small town in Switzerland, canton of Schwyz, seat of a renowned abbey of Benedictine monks since the middle of the 9th century. It is a famous resort of pilgrims who visit the place in thousands to venerate an ancient miraculous image of the Blessed Virgin. For the accommodation of the pilgrims the little town has more than 50 inns or houses of entertainment. Those pilgrimages are made throughout the year, but the great annual pilgrimage culminates on the anniversary of the dedication of the abbey's church, 14 September. The present abbey is the successor of four previous edifices which were destroyed by fire; it was erected in the first quarter of the 18th century, and is an imposing pile, in the Italian style. The place was visited by Edward Gibbon, the historian, 1755, who writes that he was "astonished by the profane ostentation of riches in the poorest corner of Europe; amidst a savage scene of woods and mountains a palace appears to have been erected by magic, and it was erected by the potent magic of religion." The abbey which Gibbon then saw is still in existence and is annually visited by more than 150,000 pilgrims. It was plundered of its vast treasure of silver and gold and precious stones by the French (1798), but it is still very rich, especially in literary monuments, possessing a library of 40,000 volumes, 1,190 manuscripts, and more than 1,000 productions of the printing press in its early period.

**Eiselen**, Wĭlhelm Bernard, vĭl'hĕlm bĕr'nārd i'zĕlĕn, German gymnast: b. Berlin 27 Sept. 1792; d. Misdroy, 22 Aug. 1846. His early studies began in Berlin, and he was the pupil of the eminent gymnast Jahns. He soon became prominent among the young gymnasts of Berlin, and in 1819 began to teach mathematics. He opened a fencing school in 1825 in Berlin and a gymnasium in 1828, and had a vast number of pupils. The first gymnasium for young girls was instituted by him in 1832. He published many works on gymnastics and fencing.

**Eisenach**, i'zĕ-nāh, Germany, town in the grand duchy of Saxe-Weimar, at the northwest end of the Thuringian Forest, at the confluence of the Nesse with the Hōrsel, 17 miles west of Gotha. In the market-place there is a monument to the memory of those from the neighborhood who fell in the war of 1870-1, and in the Karlsplatz stands the Luther memorial, unveiled in 1895. It contains many old buildings of historical and architectural importance. The manufactures are extensive, and comprise coloring materials, white-lead, woollens, beer, leather, pottery, tobacco, oil, machinery, etc. The town has many interesting historical associations. Luther

was at school here, and Sebastian Bach, to whom there is a statue, was born here. Near it is the Wartburg, where Luther resided for a time for safety. Eisenach was formerly the capital of a principality of the same name. Pop. (1900) 31,553.

**Eisenberg**, i'zën-bërg, Germany, a town in the province of Saxe-Altenburg, of great antiquity, birthplace of the philosopher Krause, whose statue is set up there. It possesses a famous castle, Christiansburg, and is the seat of many manufactures. Pop. (1895) 7,956.

**Eisenerz**, i'zën-ertz, Austria, a mining town of Austria, in the north of Styria, 20 miles northwest of Bruck. It stands in a narrow mountain valley at the foot of the Erzberg (5,000 feet), a mountain so rich in iron ore that the miners, instead of cutting mines into it and following the metal in veins, quarry the rock from the outside. Aragonite of the purest white, and resembling coral branches in form, is found in caves in the mountain. Pop. 7,000.

**Eisenmenger**, i'zën-mëng-ër, August, Austrian fresco painter: b. Vienna 11 Feb. 1830. He studied in the Vienna Academy, and early gained the first prize in drawing (1845). In 1863 he was appointed teacher of drawing in the Protestant Real-schule of Vienna. His first work of importance was the fresco which he executed in the hall of the Society of Musical Amateurs (*Musik Freunde*), 'Apollo with the Muses'; but he has painted many notable frescoes in other public buildings. He was appointed professor of the Vienna Academy in 1872, and at the same time opened a private school of fresco painting.

**Eisleben**, is'lā-bën, Germany, town in Prussian Saxony, 18 miles to the west of Halle, famous as the place where Martin Luther was born and died. The royal gymnasium, originally founded by Luther, was rebuilt in 1883. The house in which Luther died has been recently restored. In 1883, on the occasion of the celebration of the 400th anniversary of Luther's birth, a statue of him was unveiled in the market-place. Copper and silver are mined in the neighborhood of Eisleben. A considerable trade in flower and vegetable seeds is carried on. Pop. (1900) 23,900.

**Eisteddfod**, i-stet'h'vöd, the name of an assembly of Welsh bards for the purpose of musical and poetical contests. They were held at different places for the minstrels of their respective neighborhoods; at Caerwys, at Aberfraw in Anglesea, and at Mathravel in Powys. The judges were appointed by commissions from the native princes, and after the conquest from the English kings. The last was issued in 1568; but the ancient custom has been again revived by the Gwynnedigion and Cambrian societies, and annual meetings for the recitation of prize poems and performances on the harp are now held under the name of Eisteddfod. The Eisteddfod proper was announced a year and a day beforehand at an assembly called a gorsedd, at which prizes for the previous competition were awarded. At the present time yearly eisteddfods are held alternately in the north and south of Wales; and in some parts of the United States, especially throughout Pennsylvania, and other sections settled by the Welsh people, annual meetings take place, in every way similar

to the rite in their native land. During the Columbian Exposition at Chicago probably the most notable Eisteddfod held in this country, took place there.

**Ejectment and Eviction.** Ejectment in law is a mixed action, as it is resorted to in order to recover the possession of land, and damages for the wrongful withholding of it, though the damages are nominal. Originally, it was a possessory action—that is, adapted to the recovery of the possession of land. It ultimately became a convenient means of testing the title by a series of fictions. The supposition was (and this was the substance of the fiction) that a lease for a certain number of years had been made to a tenant, "John Doe," who had entered into possession, and had then been ejected by a person supposed to represent the party to be finally made defendant. This person was called "a casual ejector," and was usually represented as "Richard Roe." An action was then brought, substantially under the following title: "Doe, as tenant of Edwards (claiming the land), against Roe." A written notice was thereupon sent in the name of Roe by Edwards' attorney to the opposing claimant (Jones), who is the person in possession. By this notice Jones was advised to defend the action, otherwise Roe would permit judgment to be taken against him, and the possession would be lost. Jones, on making application to be made defendant, was allowed to defend on condition that he would admit the validity of the fictitious portion of these proceedings, so that the matter was narrowed down to a trial of the merits of the case. The action was now deemed to be between Edwards and Jones, although Doe still remained plaintiff on the records of the court. It was a rule in this action that the plaintiff can only recover upon a legal title, as distinguished from a title in a court of equity. He can succeed upon the strength of his own title, and of its validity, and not upon the weakness of that of his adversary. He must also have a right of entry. Where that does not exist another form of action must be resorted to. This method of procedure was defective in one particular. Any number of successive actions of ejectment could be brought by the plaintiff, although he had been defeated. The only check upon actions of this kind was a resort to a court of equity, for an injunction to prevent harrassing litigation. In England the fictitious portion of the proceeding was abolished by the Common Law Procedure Act of 1852, and the action placed upon satisfactory grounds. In New York and some other States the same result had been accomplished as early as 1830.

**Eviction.**—Depriving a person of his lands or tenements. Technically, the dispossession must be by judgment of law; if otherwise it is an *ouster*. Eviction may be total or partial. Total eviction takes place when the possessor is entirely deprived of his rights in the premises. Partial eviction takes place when the possessor is deprived of only a portion of them, as if a third person comes in and ejects him from a portion of his land, or establishes a right to some easement over it, by an older title than that under which he holds. See **DISPOSSESS**.

**Ekaterinburg**, ë-kä''të-rën-boorg', or **Iekaterinburg**, Russia, town, in the government and 170 miles southeast of Perm, on the east

side, and in the mining district of the Ural Mountains. It was founded in 1723 by Peter the Great. It has a mint, arsenal, custom-house, mining-school, hospital, and botanic garden. The art of cutting, polishing, and engraving gems, which are found in the neighboring mountains, is here carried to great perfection, and, together with mining and metallurgy, and a commerce in cattle and cutlery, forms the chief occupation of the inhabitants. Pop. 56,129.

**Ekaterinodar**, ě-kä''të-rë-nō-dār', Russia, town, capital of the country of the Kuban Cossacks, on the Kuban River, about 100 miles from its mouth. It is surrounded on all sides by swamp and morass; it has a cathedral and a large military hospital, but its houses are mostly of earth, with low, thatched roofs. The three annual fairs are a means of increasing trade. Pop. 70,000.

**Ekaterinoslav**, ě-kä''të-rë-nō-slāv', or **Iekaterinoslav**, Russia, (1) town, capital of a government of the same name, on the right bank of the Dnieper, 250 miles northeast of Odessa. It was founded in 1787 by Prince Potemkin, as a summer residence for the Empress Catharine II. It has a cathedral, a public library; is the see of an archbishop, and the seat of several important public offices; and it carries on a large trade with Odessa. Pop. 121,216. (2) The government of the same name has an area of 26,148 square miles and a population of 2,112,651.

**Ekhmim**, ěkh-mēm', or **Ikhmim**, ěkh-mēm' (ancient APU or KHEMMIS, and called by the Greeks Panopolis), Egypt, town, on the east bank of the Nile near Suhāg; was formerly the capital of the ninth nome of the south country. Herodotus speaks of Khemmis as a large city with a temple dedicated to Perseus, and it was still a leading place of the Thebaid in the days of Strabo; but the Arab conquest demolished the greater part. It was once famous for linen manufacture and masonry, and is still noted for its check-cotton industry. Pop. 15,200.

**Ekowe**, Africa, the capital of the province of Zululand, in the colony of Natal, in South Africa.

**Ek'ron**, the northernmost of the five great cities of the Philistines (q.v.), on the borders of Judah and Dan. Beelzebub (q.v.) was its god. Akir, a railroad station on the road from Jaffa to Jerusalem is supposed to be on the site of what was once Ekron; and some of the old buildings are said to have been built in the times mentioned in the Old Testament.

**El Bracito** (N. M.), **Battle of** (Doniphan's name BRAZITO, Mexican TEMASCALITOS), 24 Dec. 1846, in the Mexican war. Col. Doniphan, marching from California to Chihuahua, was assailed at a bend of the Rio Grande, some 25 miles from El Paso, by a battalion of Mexicans under Antonio Ponce. The Mexicans fired at long range as they charged; the Americans waited till they came close, then broke them with a destructive volley, and a company of 20 horse scattered their cavalry, which fled to the mountains. American loss, 7 wounded; Mexican, 43 killed and 150 wounded.

**El Caney**, ěl-kā'nā, Cuba, town, on the main road, four miles northeast of Santiago de Cuba. During the Spanish-American war it

was the scene of a battle between 525 Spaniards under Gen. Vara del Ray, and 4,400 Americans under Gen. Lawton. The Spaniards lost 320, and 100 were taken prisoners; the Americans lost 440. This battle occurred 1 July 1898. In 1901 the United States government purchased the battlefield and approaches for a public reservation. See SPANISH-AMERICAN WAR.

**El Dorado**. See ELDORADO.

**El Dorado**, Kan., city, county-seat of Butler County; on the Walnut River; the Atchison, T. & S. F., and the Missouri P. R.R.'s; about 25 miles east of Wichita. The city is situated in a rich agricultural region, and its principal trade is in dairy and farm products. There are several manufacturing plants, and a limestone quarry. Pop. (1900) 3,466.

**El Fasher**, ěl fā'shër, Sudan, (1) Capital of Darfur in the Egyptian Sudan. It lies at the foot of the eastern slope of the Jebel Wanda, and there is an important trade-route connecting it with Dongola on the Nile. (2) Another town of the same name stands on the river Atbara, near the Abyssinian frontier.

**El Hasa**, ěl-hā'zā, a fertile district of eastern Arabia, on the Persian Gulf, belonging to Turkey. It produces dates, wheat, millet, rice, etc. Area, 31,000 square miles. It contains the towns of El Katif, El Hofuf, and Koweit. Pop. about 160,000.

**El-Khargeh**. See KHARGEH, EL.

**El Obeid**. See OBEID, EL.

**El Paso**, ěl pā'sō, Texas, city, port of entry, county-seat of El Paso; on the Rio G.; the Atchison, T. & S. F.; the Texas & P.; the Rock I., and El Paso & N. R.R.'s; 712 miles northwest of Austin. The pass, El Paso del Norte, the principal thoroughfare between Mexico and New Mexico through the mountains, is near the city, which is a customs port. It is opposite Ciudad Juarez, the north terminus of the Mexican Central Railroad in Mexico, across the Rio Grande. El Paso has a Federal building, costing \$200,000, the Rio Grande Congregational Training School, three national banks, and various manufacturing, and carries on an extensive grain trade. The smelting establishments are remarkable, especially that of the new oil-burning blast-furnace plant of the American Smelting & Refining Company, which occupies nine acres with its closely packed buildings. It is the first establishment of the kind to use successfully oil as a power generator. The capacity of the plant which may be indefinitely expanded, is 40,000 tons of ore per month, and all ores can be treated except zinc running over 15 per cent metal. Beaumont oil for fuel is kept in an underground tank of 75,000 gallons capacity. The ores are shipped in large quantities from New Mexico and Mexico. It is a noted health resort for victims of lung trouble. In the calendar year 1900, the imports of merchandise aggregated \$1,280,985; exports, \$5,482,323; imports of gold and silver, \$12,036,602. Pop. (1900) 15,906.

**Elæagnus**, ěl-ē-ag'nūs, a genus of shrubs or small trees of the natural order *Elæagnaceæ*. The species, of which there are about 15, are natives of the northern temperate zone, and are characterized by deciduous, entire leaves covered



with silvery or brownish scales, solitary or clustered apetalous axillary flowers, and one-seeded drupaceous fruits. They are valued in ornamental gardening for their foliage, usually decorative fruits and mostly fragrant flowers. The deciduous members are hardy in the north; the evergreen ones, which mostly come from Japan and China, only in the south. They are easily propagated by means of seeds, cuttings, and layers, and succeed upon almost any well-drained soil in a sunny situation. The best known species probably are: (1) *E. angustifolia*, the oleaster, or white olive, which attains a height of about 20 feet. It has been introduced from southeastern Europe or adjacent Asia, and has proved hardy in the bleak and cold prairie States. It is one of the most ornamental species. (2) *E. argentea*, the silver-berry, a native of the colder parts of Canada and the northern border of the United States. It seldom attains a height exceeding 15 feet and is perhaps the most popular native species. (3) *E. longipes*, the goudi, a species introduced from eastern Asia. It is gaining in favor. It attains a height of about six feet and, like the preceding, bears edible, slightly acid fruit of pleasant flavor. This last species became of horticultural importance during the last 25 years of the 19th century because it produces good crops of fruit in climates too rigorous for most of the other fruit-bearing shrubs and trees.

**Elæis**, ě-lĕ'is, or **Elais**, the name given to a genus of palms, tribe *Cococa*, and the spiny section of that tribe. It is dioecious or monoecious; the flowers, especially the males, in dense masses, packed very closely together; the fruit is partly three-sided, but somewhat irregular. *E. guineensis*, the maba or oil-palm of the West African coast, has heads of large fruits. The outer or fleshy part of the fruit is boiled in water, when the oil rises to the surface and may be skimmed off. In its native country it is used for butter. It constitutes one of the chief commercial products of western Africa. *E. melanococca* also furnishes oil. Both species yield by manufacture palm-wine.

**Elæocarpacæ**, ě-lĕ-ō-kār-pā'ce-ĕ, a sub-order of *Tiliacæ*, mostly East Indian trees. The fruits of some are eaten. The deeply wrinkled seeds or stones of the fruit of *Elæocarpus ganitrus* are made into beads for necklaces and bracelets in India. They are often called olive nuts.

**Elæocarpus**, ě-lĕ-ō-kār'pūs, a genus of plants of the linden family (*Tiliacæ*), to which belongs the American basswood. The species of the genus are shrubs and trees, and are found chiefly in New Zealand, Australia, and southeastern Asia. The plants are of commercial importance wherever they grow. From the seed-stones of *E. ganitrus* the natives of Australia make necklaces. The New Zealanders find a rich black dye in *E. lunau*, and in India several species furnish one of the ingredients of curry-powder.

**Elæococca**, ě-lĕ-ō-kōk'a, a genus of the spurge family (*Euphorbiacæ*). The pressed seeds of *E. verrucosa*, a Japanese plant, furnish oil for burning, as do those of the Chinese *E. vernicia* oil for mixing with paint. Both these plants are cultivated and are now known under the common name of *Aleurites cordata*.

**Elæodendron**, ě-lĕ-ō-dĕn'drŏn, a genus of the staff-tree family (*Celastracæ*). The plants of the genus are generally trees, natives of Ceylon, southern Asia, and western and southern Africa. The drupes of *E. kumbu* are eaten at the Cape of Good Hope, while the bark of *E. roxburghii*, rubbed with water, is used by the Hindus as an external application to swellings of all kinds. *E. glaucum*, a native of Ceylon, is sometimes called the Ceylon tea-tree. Saffronwood is the product of *E. croceum*, and an oil in common use in Africa is made from *E. argan*.

**Elagabalus**, ě-la-gāb'a-lūs, or **Heliogabalus**, hĕ'li-ō-gāb'a-lūs, Roman emperor: b. Emesa 204 A.D.; d. 222. His real name was Varius Avitus Bassianus, but having, when a mere child, been appointed high-priest of the Syro-Phœnician sun-god Elagabol, he assumed the name of that deity. Soon after the death of his cousin, Caracalla, Elagabalus was proclaimed emperor by the soldiers, in opposition to the legitimate sovereign, Macrinus. The rivals met in battle at Antioch 218 A.D., Macrinus was defeated, and Elagabalus assumed the purple. His reign of three years and nine months was infamous for the debaucheries of every kind in which he indulged. He instituted ceremonies in honor of the god Elagabol, and it is believed made human sacrifices to him. He was murdered in an insurrection of the Prætorians and was succeeded by his son, Alexander Severus.

**Elaine**, ě-lā'in, or **Elain**, a name for the oily principle of fat obtained by submitting fat to the action of boiling alcohol, allowing the stearin to crystallize, and then evaporating the alcoholic solution; or by the simple process of pressing any oily or fatty substance between folds of bibulous paper, the oily matter or elaine is absorbed, while the stearin remains. The paper being then soaked in water and pressed, yields up the elaine. It possesses much the appearance and properties of vegetable oil, is liquid at the temperature of 60° F., and has an odor derived from the solid fats from which it has been extracted.

**E'lam**, the ancient name of a country or region in Asia, east of the Lower Tigris. The cuneiform inscriptions record that a king of Elam conquered Babylonia and Assyria about 2300 B.C. The later ancient writers call this country Susiana, the name being derived from its capital, Susa or Shushan, one of the most ancient cities of the East. It is now known as Khoozistan. Both the country itself, which seems to have been of considerable importance at an early period, and its capital, Shushan, are mentioned in the Bible.

Consult: Sayce, 'Inscriptions of Mal Amir'; Loftus, 'Travels and Researches in Chaldæa and Susiana'; Billerbach, 'Susa'; Dieulafoy, 'L'Acropole de Suse.'

**Eland**, ě'land, the largest antelope (*Oreas canna*) found in Africa. It is as big as a fully grown horse, weighs 1,000 pounds or more, and stands fully six feet high. The early settlers in South Africa called it "elk." The eland has a short, smooth coat of rich fawn color; strong, straight horns about 20 inches long; and a broad fringed dewlap falling about to the knees. The hide makes excellent harness



## ELANET — ELASTICITY

leather; and the flesh is decidedly palatable. The elands move so slowly, and are such gentle creatures, as to be easily caught, and hence have been nearly exterminated in their native haunts. At present very few are found. In the equatorial region of western Africa is found the still larger species (*Oreas derbianus*).

**Elanet**, ěl'a-nět, *Elanus*, a genus of *Falconidae*, allied to the kites, which they resemble in many of their characters; but from which they differ in having the short tarsi half covered with feathers, and the claws, except that of the middle toe, rounded beneath. The tail is very little forked. One species (*E. melanopterus*) is common in Africa from Egypt to the Cape of Good Hope, and is found also in India. Another species is the black-shouldered hawk (*E. dispar*) of America, the northern limit of which appears to be South Carolina. Both of these feed chiefly on insects, which they catch on the wing, but they also prey on small birds and reptiles.

**Elapidae**, ěl-láp'í-dē, or **Elapinae**, a group of highly venomous snakes, having a short, rounded head covered with plates. They are more nearly related to the harmless colubrids than to the vipers, but have a poison apparatus of the proteroglyph type, which are smaller than in the viperine snakes, but very deadly. The group is a large one and found in most parts of the world, but is most numerous in the tropics. Nearly all the snakes of Australia are elapine, the whole race of cobras (q.v.), the coral and harlequin snakes and others. The genus *Elaps* is entirely American, and is represented by a single species in the United States (Florida).

**Elaps**, ělaps. See CORAL-SNAKE.

**Elasmobranchii**, ěl-lās-mō-brāŋ'k'ī-ī, a subclass of fishes, containing the sharks and rays. The skull is cartilaginous with only superficial calcifications and no true dermal bones; the gills fixed and shaped like pouches; the upper jaw is the pterygo-palatine bar, and the lower jaw Meckel's cartilage, attached to the skull by a large hyo-mandibular element; the exoskeleton consists of tooth-like granular tubercles or spines; and the trunk endoskeleton is cartilaginous. The ventral fins are far back and bear claspers in the males; the heart has but one auricle and one ventricle; and the intestine is provided with a spiral valve. The group is nearly coextensive with Cuvier's *Chondropterygia* or cartilaginous fishes and the Placoidi of Agassiz, and has received various other names such as *Selachii* and *Plagiostomi*. Cope distinguishes as orders the *Selachii*, which includes all living as well as many extinct forms; and the *Ichthyotomi*, which are exclusively carboniferous and have simple claspers and extensive cranial calcifications. See DOGFISH, RAY, SAWFISH, SHARK, SKATE, etc.

**Elasmosaurians**, ěl-lās-mō-sā'rī-anz, gigantic marine fossil reptiles of the order *Sauropterygia*, found in cretaceous beds. As a living animal it was contemporaneous with *Plesiosaurus*, of the same order, which abounded in the eastern hemisphere, and as a fossil has been found in Europe and New Zealand. *Elasmosaurus* had a lizard-like, elongated body, sometimes 45 feet long, flattened limbs which served as oars, and a long, paddle-shaped tail which assisted its motion through the water. The head

was proportionately small, and with the neck performed twisting motions much like the corresponding parts of the swan. The contents discovered in the body indicate that this saurian lived on other rapacious fish, which it was able to seize with its crocodile-teeth. The fossil has been raised from cretaceous beds in New Jersey and in Kansas.

**Elasmotherium**, ěl-lās-mō-thē'rī-ūm, an extinct rhinoceros which inhabited Siberia and Russia during the Pleistocene Epoch. It exceeded the Indian rhinoceros in size, and bore an enormous horn on the frontal bone of the skull. The teeth are very long-crowned, with the enamel ridges strongly crenulated. Some of the native Siberian legends are supposed to refer to this animal; it was a contemporary of early man in that region.

**Elastic Limit**. See ELASTICITY.

**Elastic Tissue**, fibrous tissue in most cases mixed with the fibres of areolar tissue. It occurs in the ligaments of the vertebrae, that of the jaw, etc., also in connection with arteries, veins, and lymphatics. It is used in the animal structure whenever an extensible and highly elastic material is required.

**Elasticity**, that property of bodies in virtue of which they tend to return to their original shape or bulk, after having been subjected to distortion, compression, or extension. The fundamental principles of the theory of elasticity are well understood; but in applying these principles to the precise solution of the practical

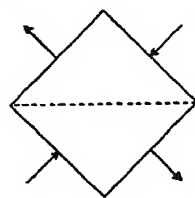


FIG. 1.

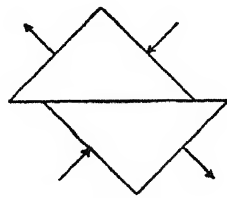


FIG. 2.

problems that arise in physics and engineering, mathematical difficulties are encountered which often appear to be insuperable. In fact, there are comparatively few problems in elasticity whose solutions are known with precision, except in those cases in which the deformation of the body under consideration is exceedingly small. In the study of such problems we have to deal (1) with the deformation that the elastic body experiences, and (2) with the forces that are associated with that deformation. In the convenient phraseology of Rankine (which has been generally adopted by later writers), the deformation itself is called a "strain," and the internal forces that the continued existence of this strain implies are collectively known as the "stress." Rankine's own language on this point is as follows, save for a single minor modification: "The word 'strain' will be used to denote the change of volume and figure constituting the deviation of a definite elementary portion of a solid from that condition which it preserves when free from the action of external forces; and the word 'stress' will be used to denote the force, or combination of forces, which this same elementary portion exerts in tending to recover its free condition, and which, for a state of equi-

## ELASTICITY

librium, is equal and opposite to the combination of external forces applied to it." These definitions being established, the theory of elasticity may be defined as that branch of pure mechanics which deals with the stresses and strains to which elastic bodies are subject. In an æolotropic or anisotropic body, such as a crystal belonging to the orthorhombic, monoclinic, or triclinic system (see CRYSTAL), the elastic properties are different in different directions, and it is found that the equations that are required in order completely to specify the connection between the stresses and strains that may exist in such a body involve no less than 21 constants.

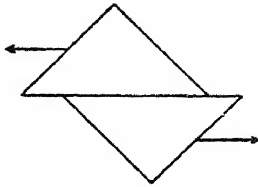


FIG. 3.

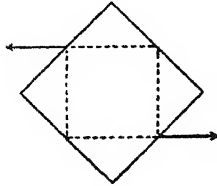


FIG. 4.

It is easy to understand that this fact implies enormous mathematical difficulties in the solution of problems relating to such bodies; and these intrinsic difficulties are still further enhanced by the fact that there is probably not one substance in nature, for which the actual numerical values of these constants are all known. (For a thorough but necessarily difficult discussion of the elastic theory of crystalline bodies, consult Rankine's 'Axes of Elasticity and Crystalline Forms,' in his 'Miscellaneous Scientific Papers.') When, on the other hand, the body has exactly the same properties in all directions (or is "isotropic"), it is found that only two constants are required; but even in this comparatively simple case the mathematical difficulties of the general theory are so great that it is usually impossible to solve problems in which the deformations to be considered are of any considerable magnitude.

In the remaining portion of this article it will be assumed that the body under consideration is strictly isotropic—that is, that it has the same

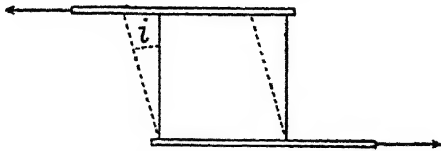


FIG. 5.

elastic properties in all directions, and in all its parts. Fortunately this restriction is not incompatible with the great majority of problems that arise in practical work. In such a body, as has been said above, there are but two independent elastic constants, which have to be determined by experiment for the particular substance under consideration. These are known, respectively, as the "bulk modulus" (or "volume modulus"), and the "modulus of simple rigidity," though numerous other names are also applied to them. If  $V$  is the original volume of an isotropic solid, and  $V - v$  is its volume when

subjected to a uniform normal pressure of  $P$  pounds per square inch over its entire surface, then  $\frac{v}{V}$  is called the "compression," and the "bulk modulus" of the body (which is commonly represented by the letter  $k$ ) is defined as

$$k = P \div \left( \frac{v}{V} \right) = P \left( \frac{V}{v} \right)$$

The values of this modulus for some few common substances are given below.

The modulus of simple rigidity is usually defined by reference to the distortion that a small cubical portion of the unstrained solid undergoes when the distorting force is applied. Fig. 1 represents a cube of this sort, which is supposed to be so small that the force acting upon any one of its faces may be considered to be uniform over the entire face. When such a cube is in equilibrium the most general kind of stress to which it can be subjected is resolvable into stresses of two types: (1) a uniform compressive stress, acting with equal intensity on all its faces, and therefore tending merely to alter its volume without producing any distortion of form; and (2) four equal forces, acting upon four of the faces, and disposed in pairs as shown in Fig. 1, one pair being directed inward and the other pair outward. The system of forces shown in Fig. 1 tends to alter the shape of the cube by extending it in one direction, and flattening it in a direction at right angles thereto; but there is no tendency in such a system to alter the bulk of the cube, since the extension produced by one of the pairs of forces is exactly neutralized by the compression produced by the other pair. If the dotted line in Fig. 1 were a line of weakness across the cube, it is evident that the effect of the force-system in that figure would be to cause the upper part of the cube to slip, relatively to the lower part, as suggested in Fig. 2. In fact, if the forces acting upon the upper part are compounded together, and those acting upon the lower part are also compounded in the same manner, it is plain that the four forces of Fig. 1 may be considered to be equivalent to the two that are shown in Fig. 3; so that the tendency of the stress-system shown in Fig. 1 is merely to cause one part of the cube to slide, relatively to the other part, along a plane that is parallel to the direction in which the resultant forces act. A stress such as is here described is called a "shear." To estimate the resistance of a body to deformation by the action of a shearing stress, consider a small cube to be cut from the original one, as suggested by the dotted lines in Fig. 4; and for the sake of fixing the ideas, let strips be conceived to be cemented to this cube at the top and bottom, as indicated in Fig. 5, so that the equal and opposite distorting forces can be conveniently applied. Then the effect of the forces in Fig. 5 will be to distort the cube into the shape indicated by the oblique dotted lines, and the magnitude of the angle  $i$  may be taken as the measure of the rigidity of the material of which the cube is composed; this angle being smaller (for a given shearing stress), the greater the rigidity of the substance considered. Stresses such as those shown in Fig. 5 are said to be "tangential"; and the "modulus of rigidity" of a substance may be obtained experimentally by applying such a pair of tangential

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forces to a unit cube of the substance, and then dividing either of these equal and opposite tangential forces by the observed value of the angle  $\epsilon$ , as expressed in radians. The modulus of rigidity is commonly denoted by the letter  $n$ .

The bulk modulus and the modulus of rigidity of an isotropic substance being known, problems concerning the elastic behavior of that substance can be solved by known mathematical methods, when the strains to be considered are quite small. For these methods, advanced treatises on theoretical mechanics must be consulted. One of the best books, so far as the presentation of the general principles of the subject is concerned, is that of H. Poincaré, (*Leçons sur la théorie de l'élasticité*.)

Different bodies possess different degrees of elasticity, both of bulk and of form, and the elasticity of the same body will usually vary sensibly with the temperature. A body in which a certain definite strain is always accompanied by identically the same condition of stress, at a given temperature, without regard to the variations of temperature, bulk, and form to which it may have been subjected in the intervals between successive repetitions of the experiment, is said to be "perfectly elastic." Fluids (that is, gases and liquids) possess perfect elasticity of bulk, since a given fluid always requires the application of the same pressure, in order that its bulk may be diminished by a given constant amount, at a fixed temperature. Many solids also appear to possess perfect elasticity, both of bulk and of form, so long as the strains to which they are subjected do not exceed certain limiting values. Thus when a bar of steel is extended by the application of a longitudinal tension, it will return to its original length when the tension is removed, provided the extension that was produced (when expressed as a fraction of the total length of the bar) did not exceed a certain limit. If the extension exceeded this limit, the bar will shorten upon the removal of the tensile force, but will not return precisely to its original length. The permanent elongation so produced is technically known as the "permanent set" of the material. The tensile force that will just extend a bar of unit sectional area to the point at which it first receives a permanent set, is often called, commercially, the "elastic limit" of the material; though the expression "yield point," which is less generally employed, appears to be preferable. When a tensile force is applied to such a bar as we have been considering, and in such a manner that the force, at first zero, increases gradually up to a maximum value, the bar stretches under its influence, and it is observed that for a considerable time the extension of the bar is almost precisely proportional, at any given instant, to the force that is being exerted at that instant. As the bar approaches its yield point, however, the extension is found to exceed the value that it would have if the law of proportionality held good up to the yield point. The tensile force to which a bar of unit sectional area is subjected when the departure of the extension from strict proportionality to the force is first observed is also often called the "elastic limit" of the material; though, since it does not coincide with the yield point, it is more accurately described as the "limit of proportionality." The general phenomena here discussed are observed also in connection with strains other than

mere extensions. Thus when solid bodies are deformed in any way by the application of an external force, a permanent set is observed if the deforming force is large enough; and the deformation, which at the outset is proportional to the applied force, ceases to be so when that force attains to a certain limiting value. In some cases, however, fracture of the material may supervene before any permanent residual set can be actually realized, and the deformation of the material may also remain sensibly proportional to the applied force, even up to the point of fracture. The general law that the distortion of an elastic body is strictly proportional to the applied force, provided that force does not exceed a certain limit, is known as "Hooke's law," from the fact that it was first explicitly stated by Robert Hooke, for the simple case of the extension of a bar by tension (*Ut tensio sic vis*).

When a straight bar of metal (or other solid substance) is subjected to an endwise pull, it elongates in the direction of the tension, and contracts in all directions at right angles thereto. If  $L$  is the original length of the unstrained bar, and  $L + l$  is its length when sub-

jected to the longitudinal tension  $P$ , the ratio  $\frac{l}{L}$

is called the "longitudinal extension" of the bar, under the influence of the tension  $P$ . From Hooke's law it follows that the longitudinal extension, as so defined, is proportional (for small strains) to the force  $P$ , so that the quotient obtained by dividing the force  $P$  by the longitudinal extension that it produces is constant. When the sectional area of the bar is unity (or, what amounts to the same thing, when  $P$  is the tension per unit of sectional area of the bar),

this constant, which has the value  $\frac{PL}{l}$ , and is

usually denoted by the letter  $E$ , is called "Young's modulus," from the fact that its importance was first recognized by Dr. Thomas Young. Since the elastic properties of an isotropic body are determinate when the "bulk modulus,"  $k$ , and "modulus of rigidity,"  $n$ , are known, it follows the Young's modulus,  $E$ , is not independent of these two. In fact it can be shown that the simple relation

$$E = \frac{9nk}{3k + n}$$

must hold true among these three quantities.

It has been said above that when a bar is exposed to simple longitudinal tension its diameter diminishes simultaneously with the increase of its length. Let the absolute diminution of the diameter be divided by the diameter itself, and the absolute increase in the length be divided, similarly, by the length itself; and let these two quotients be designated, respectively, as the "lateral contraction," and the "longitudinal dilation." The ratio of the lateral contraction to the longitudinal dilation is an important physical quantity, which is called "Poisson's ratio," after the French mathematician Poisson, who studied it extensively. Mallock found it to be 0.253 for steel, 0.325 for brass, 0.348 for copper, 0.375 for lead, 0.50 for india rubber and paraffin, and zero for cork. Poisson and Navier concluded from erroneous mathematical reasoning that the ratio in question is precisely 0.250 for all iso-

## ELASTIN — ELATERIUM

tropic bodies, and in this they were followed by Cauchy and many other distinguished authorities. It may be shown, however, that Poisson's ratio is expressible in terms of the bulk modulus and the modulus of rigidity by means of the formula

$$\text{Poisson's Ratio} = \frac{3k - 2n}{2(3k + n)}$$

This expression cannot be numerically equal to 0.250, unless the modulus of rigidity is precisely three fifths of the bulk modulus — a relation that could not be assumed to hold true generally, and which we know, from experiment, to be false for multitudes of bodies that are sensibly isotropic. The wide range of values observed by Mallock therefore corresponds, in all probability, to a similar variation in the actual value of the constant, and cannot be safely attributed to errors of experiment.

The various moduli to which reference has been made have been determined experimentally for many substances. They differ appreciably in different specimens of the same substance, being influenced both by the chemical composition and by the physical state of the specimen tested. In the following short table values are given that will apply with a fair degree of accuracy to the average specimens of steel, brass, and glass that are likely to be met with in practical problems:

Modulus	Substance		
	Steel	Brass	Glass
Young's.....	30,000,000	14,000,000	7,200,000
Rigidity.....	12,000,000	5,200,000	2,900,000
Bulk.....	26,000,000	14,000,000	5,800,000

In this table the unit of length is the inch, the unit of force is the attraction that the earth exerts upon one pound of matter, and stress is supposed to be expressed in pounds per square inch. The several moduli here given do not strictly satisfy the formula given above for expressing Young's modulus in terms of the bulk modulus and the modulus of rigidity; but that is because they are averages of numerous results, taken from a variety of sources, and it appears to be better to give the experimental averages just as they were obtained, rather than to manipulate them so as to bring them into precise conformity with the formula. The formula itself is sufficiently trustworthy to serve for the calculation of any one of the three moduli of a given substance, when the other two moduli of that substance are known. Consult for further numerical data Rankine, 'Useful Rules and Tables'; and Everett, 'Units and Physical Constants.' In the latter book the data are given in the C. G. S. system.

**Elastin**, an insoluble proteid substance, of which the elastic fibres of connective tissue are composed. It may be conveniently prepared from the *ligamentum nucha*, by boiling with ether and alcohol (to remove the fats), and afterward by prolonged boiling, successively, with water, strong acetic acid, and concentrated caustic soda, and subsequent successive treatment with weak acetic acid, water, hydrochloric acid, and water. When so prepared, elastin is not soluble (without decomposition) in any known solvent. It dissolves with decomposition

in concentrated sulphuric acid, however, yielding leucin, but not tyrrsin. Elastin is digested both by pepsin and by trypsin, and it contains no sulphur. Its percentage composition, according to Muller, is: C=55.45; H=7.41; N=16.19; O=20.89.

**Elate'a.** See CITHÆRON.

**Elater**, ěl-à-tër, a genus of beetles in the pentamerous sub-order, type of the family *Elaterida*. They are familiarly known as "click-beetles" or "skip-jacks," from their habit of jerking themselves with a slight noise into the air when they land or are placed on their backs. The body is arched upward and suddenly straightened with a violent muscular exertion, which lifts the animal from the ground. The legs are too short for the ordinary method of righting the body. The larvæ are only too familiar as "wireworms" (q.v.). Some tropical forms are phosphorescent. See FIREFLY.

**Elateridæ**, ěl-à-tër'î-dē, a family of *Coleoptera* (click-beetles), tribe *Pentameræ*, sub-tribe *Sternoxia*. It contains the insects placed by Linnæus in his great genus *Elater*, now broken up into many genera. See CLICK-BEETLE; FIREFLY.

**Elat'erin**, a neutral chemical substance having the formula  $C_{20}H_{28}O_6$ , and obtained by alcoholic extraction of the greenish precipitate thrown down by the juice of the slightly unripe squirting cucumber, *Ecballium elaterium*. It crystallizes in hexagonal tablets which melt at 400° F., and are insoluble in water, but soluble in chloroform and in hot alcohol. Elaterin has a bitter taste, and is a powerful purgative, the dose being from the 40th to the 10th of a grain. A crimson color, changing to a scarlet, is produced when sulphuric acid is added to a solution of elaterin in carbolic acid; this reaction serving as a test for its presence.

**Elat'erite**, an elastic, asphalt-like mineral, known as "elastic bitumen." In color it is dark brown, with a specific gravity ranging from 0.9 to 1.2. It occurs abundantly in Derbyshire, England, and a mineral closely allied to it has been found at Woodbury, Conn.

**Elaterium**, ěl-à-tě'rî-um, a mixture of principles formed as a precipitate, occurring spontaneously in the juice of the fruit of the wild or squirting cucumber, *Ecballium elaterium*, the active principle of which is elaterin. The squirting cucumber is a small perennial, of the cucumber family, indigenous in Persia, India and the warmer Oriental countries, and has been extensively cultivated even as far north as England. The fruit itself is 1½ to 3 inches long by 1-3 to 3-4 of an inch, oblong or oval in shape, covered with soft bristles, and yellowish green in color. It is firm externally. As the fruit ripens fermentation takes place in the interior with the formation of gas. This accumulates in sufficient quantities to exert considerable pressure, bursting the fruit at its base and squirting the seeds some distance. In this manner the fruit is distributed. Elaterium has been used for centuries as a cathartic, the phenomena of the squirting seeds having suggested its function. Elaterin itself is an neutral principle of the formula  $C_{20}H_{28}O_6$ . It forms in minute white prismatic crystals, without odor and with a slightly gritty and bitter taste. Elaterin is one of the most active of all the hydragogue cathar-

tics. It operates with violence even in minute doses. It is particularly of service in conditions in which there is general dropsy and no inflammatory condition of the intestinal tract. Elaterin is given in doses of from 1-40 to 1-10 of a grain.

**Elba** (Lat. *Ilva*; Gr. *Ætalia*), a small island belonging to the kingdom of Italy, in the Mediterranean Sea, off the coast of Tuscany, and with several much smaller isles, lying at the mouth of the Gulf of Piombino. The island of Elba is 18 miles from east to west, with a width varying from  $2\frac{1}{2}$  to 12 miles in its widest part. The mountainous districts of the island yield large quantities of superior iron, marble, lodestones, and alum, besides wines and fruits. On the first abdication of Napoleon in 1814, Elba was assigned to him as a residence and empire. Here he accordingly took up his residence, in the month of May; and on 26 Feb. 1815, he secretly left the island, and, landing in France, began that brief and final career, known in history as the "Hundred Days." Elba was a place of celebrity in the time of the Romans, and famed then, as now, for its yield of iron. Two good ports are Porto-Ferraio and Porto-Longone, both well fortified. Pop. 25,480.

**Elbe**, ěl'bě (ancient ALBIS; Bohemian, LABE), a river of Germany, one of the largest in Europe. It rises on the southwest slopes of the Schneekoppe or Snowcap, one of the Riesengebirge, between Bohemia and Silesia. From this point it flows nearly due south into Bohemia for about 50 miles, when it turns to the west, and after about 40 miles takes a general north-northwest direction till it empties into the North Sea, intersecting Saxony, a considerable portion of Prussia, and in the latter part of its course separating Holstein on its right from Hanover on the left. The length, including windings, is upward of 780 miles. The principal affluents are on the right, the Iser, Schwarz-Elster, and Havel; on the left, the Alder, Moldau, Eger, Mulda, and Saale. In the lower part of its course the river is divided by five large and seven small islands into several arms, which unite again about five miles below Hamburg. The mean depth is 10 feet, average breadth 900 feet. It is more or less navigable for about 470 miles, but its estuary at Cuxhaven is much encumbered with sandbanks. It is well stocked with fish. On 1 July 1870, the navigation of the Elbe was declared free from Hamburg to Melnik in Bohemia. There is an important system of canal navigation in connection with the Elbe, Hamburg, for instance, being in this way connected with Berlin.

**Elberfeld**, ěl'běr-fěld, Germany, town in the Prussian Rhine province; 15 miles east of Düsseldorf, in the beautiful valley, and on both sides of the Wupper, enclosed by lofty hills. It has no historical or antiquarian importance. Its prosperity has been acquired mostly within the present century, and is due to the cotton manufacture, of which it is the central locality in Rhenish Prussia. In addition to the cotton manufacture, which, under a variety of forms, is the great staple of the town, linen, woolen, silk and mixed silk goods, ribbons, and velvet are extensively made, and largely exported. There are also numerous mills for spinning cotton twist, linen yarn, and worsted, and dye-works,

celebrated for the richness of their colors. The environs are almost covered with bleachfields. Pop. (1900) 298,884.

**Elberfeld System**, a system of poor-relief which originated in the appointment of six visitors in 1800, to investigate applications for aid, in the manufacturing town of Elberfeld, Prussia. The city was subsequently divided into districts, the number of visitors was increased, and the operations developed, until by 1852 what has become known universally as the Elberfeld System was adopted. Its main features are the division of the city into 26 districts subdivided into 364 precincts, each precinct being administered by an almoner who investigates each application, in cases of emergency provides immediate assistance, and as long as aid is afforded, visits the applicant twice a month. Money relief is granted fortnightly according to a fixed schedule, any earnings in the meantime being deducted; when needed, working implements are provided. A meeting of the almoners under the presidency of an overseer takes place every fortnight to discuss cases and to vote necessary relief, a report of the meeting being laid the next day before the directors who are chosen from four councilmen and four citizens with the mayor as chairman *ex officio*. The directors superintend and advise on the whole city's work. The positions of almoners, overseers, and directors are of a purely honorary character. The advantages of the system in the improvement of the condition of the poor have been strongly apparent, the ratio of persons assisted in 1889 being 7 per 1,000 as against 17 per 1,000 in 1855. See also CHARITIES.

**Elberon**, N. J., sea-coast summer resort in Monmouth County, on the Pennsylvania and the Central Railroad of New Jersey. Pop. (1901) 200. Here President James A. Garfield (q.v.) was taken' after he was shot by Guiteau, 6 Sept. 1881, and died here 19 Sept.

**Elberton**, Ga., city, county-seat of Elberton County; on the Southern and the Seaboard A. L. R.R.'s; 90 miles northeast of Atlanta. It is in a cotton-growing section and the chief industries are connected with the cultivating, shipping, and manufacturing of cotton. It contains manufactories for cottonseed-oil, cotton goods, compressing cotton, and for fertilizers for the cotton plant. The quarries nearby give employment to a number. Pop. 3,902.

**Elbeuf**, ěl'béf, France, town, in the department of Seine-Inférieure, 11 miles south-southwest of Rouen, situated in a beautiful valley on the left bank of the Seine. It has handsome churches, public buildings, and homes. It has spinning-mills, dye-works, and all accessories for the complete production of woollen manufactures, chiefly of lighter cloths, checkered stuffs, fine colored flannel fabrics, and all kinds of fancy goods. Pop. 40,500.

**Elbing**, Germany, seaport town, in West Prussia, on the Elbing, near its entrance into the Frische-Haff, 32 miles east-southeast of Dantzic. It is divided into the old and new towns, the former of which was once surrounded by turreted walls and gates, but these for the most part have been removed. It has ship-building yards, which do a considerable trade in building and repairing vessels. Its manufactures include cloth, leather, soap, tobacco, and beer.

By means of a canal it has connection with the Vistula, and the harbor was improved by the opening in 1884 of a mole 3,500 yards long. Pop. 50,121.

**Elbow.** See ARM.

**Elbow Joint.** See ARM.

**Elbruz**, ɛl'brooz, or **Elburz**, (1) A mountain range of Persia, running for 450 miles along the southern border of the Caspian Sea. It has a number of subordinate parallel ridges, enclosing extensive and fertile valleys; and unlike most Persian ranges, it has numerous prominent spurs, the highest peak being Mount Demavend (q.v.). (2) Elbruz is also the name of the loftiest summit of the Caucasus.

**Elcano**, Juan Sebastian de, hoo-än' sä-bäs-tē-än' dā älkä'nō, Spanish navigator: b. Guetaria, Guipuzcoa. He was captain of the Concepcion, accompanying Magellan and was the first to circumnavigate the world, completing his journey of three years 8 Sept. 1522. He went with Garcia Jofre di Loaysa on the westward voyage to the Moluccas, and died after passing the straits of Magellan and gaining the Pacific.

**Elcesaites**, ɛl-sē'sa-its, or **Elkesaites**, a sect founded in the 2nd century, during the reign of Trajan. They derived their belief from the teachings of the Book of Elkesai, supposed to have been inspired by an angel. Their system seems to have been a commingling of Oriental philosophy with Sudaism and early Christianity. Probably put into practice with the idea of satisfying the want of those persons seriously troubled by the religious chaos of the day caused by the mighty conflict of greater creeds. The followers of Elkesai or Elxai are often confounded with Ebionites (q.v.). The best account we have of the Elcesaites is given by Hippolytus in his chief work, 'Philosophumena.'

**Elche**, ɛl'chā (ancient ILLICI), Spain, town in the province and 14 miles west-southwest of Alicante, on the Vinalopo River. It is an ancient place, containing various Roman remains, also buildings showing the work of the Moorish architect. Dates, pomegranates, articles made from esparto grass, oil, leather, woolen goods, and wine are among the exports. Pop. 24,300.

**Elchingen**, ɛl'hing-ən, Bavaria, village, on the Danube, nine miles northeast of Ulm, which gave the title of Duke of Elchingen to Marshal Ney, who here defeated the Austrians 14 Oct. 1805. In the neighborhood are the ruins of a Benedictine Abbey of the same name, founded in 1128. There are two villages, Ober and Unter Elchingen, the former on the same hill with the abbey, the latter to the northeast of it. The hill on which the abbey stood was occupied by Mack, who had his headquarters in Ulm; while Ney, on the right bank of the river, repaired the bridge of Elchingen, forced the passage of the river, and took Elchingen by storm.

**Elder, John**, English engineer: b. Glasgow 1824; d. 1869. Educated in Glasgow, he was first employed as director of the drawing office of Napier's establishment, becoming later a member of the great ship-building firm which was known after 1860 as Randolph, Elder & Company, employing more than 4,000 men. His fame rests upon his invention of the com-

pound or combined high and low pressure engines, saving nearly 40 per cent of fuel.

**Elder, Susan Blanchard**, American writer: b. Fort Jessup, La., 19 April 1835. She was married to C. D. Elder of New Orleans. She began to write for the press, under the name 'HERMINE,' when quite young. She has published: 'The Loss of the Papacy'; 'James the Second'; 'Savonarola.' Her contributions to Roman Catholic publications are numerous, and her devotional poems are very popular. Her dramas are written for representation in Roman Catholic colleges.

**Elder, William Henry**, American Roman Catholic prelate: b. Baltimore, Md. 22 March 1819. He was educated at Mount St. Mary's College, Emmitsburg, and at the College of the Propaganda at Rome; and ordained to the priesthood in 1846. On his return to the United States he was appointed president and also professor of theology in Mount St. Mary's, where he remained till his consecration as Bishop of Natchez in 1857. During the Civil War he gave much of his time to the care of the wounded. When an order was issued by a post-commandant at Natchez, directing all clergymen to pray for the President of the United States, Bishop Elder refused to obey, on the ground that civil authorities could not change the form of the Mass. He was arrested and sent out of the diocese to Vidalia, La., but the order was soon revoked. During the yellow fever epidemic of 1878 in Mississippi he was in constant attendance on the sick till stricken with the disease himself. He was appointed coadjutor archbishop of Cincinnati in 1880; presided over the Provincial Council of Cincinnati in 1882, and on the death of Archbishop Purcell, the same year, became archbishop of Cincinnati.

**Elder**, *Sambucus*, a genus of shrubs or small trees and a few perennial herbs of the natural order *Caprifoliaceae*. There are about 20 widely distributed species characterized by opposite, pinnate leaves, small white flowers usually in compound cymes, and black, red, white or green, juicy fruits (berries or drupes). Many of the species are used in ornamental planting, since they are readily propagated by root and stem cuttings, succeed well upon nearly all soils, are of rapid growth, graceful form, and are attractive both in flower and fruit. The best-known species in America is *S. canadensis*, the common or sweet elder, which is frequently seen in fence-rows, along roadsides, and on the margins of woods throughout southern Canada and the greater part of the United States. It attains a height of 10 feet or more, bears abundant fragrant flowers in midsummer and black berries in early autumn. These fruits are used where they can be obtained plentifully for making pies and elderberry wine. Several horticultural varieties have been introduced for their golden or variegated foliage, and one variety with large fruits was introduced in 1890. The flowers are used for making a wine, a perfume, and a "water" used in confectionery. Economically this species ranks as a minor fruit. Like some other members of its genus, it has also been used in medicine, but is rapidly giving place to other drugs. Probably *S. nigra*, the common European elder, ranks next in importance. It is much larger, often attaining a



height of more than 20 feet. The yellow, hard, tough wood is readily polished and is used for making skewers, fishing-rods, needles for making fish-nets, and as a substitute for boxwood. It is also employed for the same horticultural and economic purposes as the preceding species, and has numerous fancy-leaved varieties. Other well-known species are the scarlet elder (*S. racemosa*), an Old-World species, and the red-berried elder (*S. pubens*), a native of North America, considered by some botanists to be identical. There are also several unrelated plants which are popularly known as elder, as box-elder (*Negundo aceroides*), wild elder (*Aralia hispida*), also known as bristly sarsaparilla, and marsh-elder (*Iva frutescens*).

**Elders**, among Calvinistic churches, a body of men elected by the communicants from among their number to aid the minister in portions of his spiritual work. With the minister, they constitute the executive of the congregation. Among the Jews the elders are the rulers or magistrates of the people. The instinct of mankind considers the old fitter than the young to rule, and at first probably every "elder" was really pretty well advanced in life; but the designation ultimately came to be used more of office than of age. "The elders of the congregation," or simply "the elders," are mentioned as early as Lev. iv. 15. Seventy of them were appointed as associates of Moses (Num. xi. 16). They are combined with the officers (Deut. xix. 12), with the princes (Ezra x. 8), with the priests (Lam. i. 19). In the New Testament they are described as having given currency to traditions (Matt. xv. 2), and taken a chief part in compassing the death of Jesus (Matt. xxvi. 59; xxvii. 20), etc. There were elders, also, of single towns, as of Succoth (Judges viii. 14), and of Jezreel (2 Kings x. 1).

**Eldon, John Scott**, EARL OF, English jurist: b. Newcastle 4 June 1751; d. London 13 Jan. 1838. He was educated at Oxford; was called to the bar in 1776, and in 1782 was made king's counsel. Next year he entered Parliament, supported Pitt, and was made solicitor-general and knighted. In 1793 he became attorney-general, and in 1799 was created chief justice of the court of common pleas, and raised to the peerage and the House of Lords under the title of Baron Eldon. He became lord chancellor (1801), and retained this post under the subsequent administration of Pitt until the death of the latter in 1806. A year later, however, he resumed the chancellorship under Liverpool, and held it without break for 20 years. In 1821 he was created an earl by George IV. On the accession of the Canning ministry in 1827 he resigned the chancellorship, and never again held office. As a lawyer he was a master of English jurisprudence; as a politician he was opposed to reform. See Campbell, 'Lives of the Lord Chancellors'; Tuiss, 'Public and Private Life of Lord Eldon' (1844).

**Eldo'ra**, Iowa, city, county-seat of Hardin County, near the Iowa River, on the Iowa Central, and the Chicago, I. & D. R.R.'s; 122 miles west of Dubuque. The region is rich in deposits of clay, and brick making, the manufacture of tiles and sewer pipes are the chief industries. Pop. (1900) 2,233.

**Eldorado**, ɛl-dō-rä-dō (from the Spanish *El Dorado*, the Gilded Man), the region of un-

discovered treasure in South America. In the article DABAIBA we have traced the famous Eldorado myth back to those stories which, at the beginning of the 16th century, were current among the Indians of Darien about "a temple lined with gold," and have shown why the Spanish explorers failed to recognize in distant Cuzco, with its temple of the sun-god, the real basis of such accounts. The name Eldorado, however, with which the ever-receding or shifting territory, the subject of all those stories, has been stamped, was at first not the name of a place but of a person; and the name-giving addition to the myth is localized very precisely in the table-land of Bogotá, as follows: Lake Guatavita (north of the present capital of Colombia; elevation above sea-level 3,199 metres) was regarded by Indian tribes dwelling in that neighborhood in the 15th century as a holy place, and pilgrims who resorted to it often cast their offerings of gold and emeralds into its waters. Whenever a new chief of Guatavita was chosen, nobles and priests of his tribe bore him to the lake, as A. F. Bandelier has written, "upon a barrow hung with disks of gold. His naked body was anointed with resinous gums and covered all over with gold-dust." The chief plunged into the lake; spectators made the usual offerings of gold and jewels; and, on the conclusion of this ceremony of consecration, the new ruler and his subjects went down to dance and feast in Guatavita village. The Chibchas, (q.v.) conquered Guatavita about the end of the 15th century, and under their general government this extraordinary local custom had been discontinued for a number of years before the first Spanish settlements were made on the Caribbean coast—there was no longer an independent Guatavita chief to signify his acceptance of the local religious beliefs in a fashion so dramatic; but native folk-lore continued for a century, at least, to make much of this glittering symbolic figure and the sacred lake. In 1529, Dalfinger, governor of the German colony in Venezuela, set out from his little capital of Coro, and probably reached the edge of the high plain of Bogotá by way of the Magdalena River; there the resistance of the Indians obliged him to turn back. Four years later the report of the vast treasure secured by the conquerors of Peru (Atahualpa's "ransom" alone was officially valued at 3,933,000 ducats of gold and 672,670 ducats of silver) appeared to justify ventures undertaken in reliance upon the wildest Eldorado tales. It is also true that a fresh outbreak of the gold-fever affected the Spanish colonists everywhere in America, more or less, but especially those in the agricultural settlements (Compare: DOMINICAN REPUBLIC, sub-title *History*); and that leaders of those colonies, in order to retain their men, were obliged to make fresh efforts to find treasure. In Santa Marta, an expedition was organized to ascend the Magdalena River to the highlands; at Coro, Georg von Speyer organized a campaign for the exploration of the Meta plain, far inland. The former expedition under command of Quesada in 1537 reached the old home of the gilded chief; and although Guatavita either hid its gold or was actually poor (40 years having passed since it had ceased to be a place of pilgrimage), the treasure collected in this neighborhood, principally at the villages of Tunja and Iraca, was officially valued at 246,676 pesos in gold, or

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about \$1,200,000, besides 1,815 emeralds. Von Speyer went astray among the tributaries of the upper Orinoco, but his lieutenant, the German, Nicolaus Federmann, leading a company from Coro, reached the Bogotá highlands in time to meet there not only Quesada but the conqueror of Ecuador, Benalcázar, who came up from the south, having also heard the story of the Gilded Man. Each of these leaders considered himself the discoverer of the country, and they proceeded together to Spain, to submit their claims to the Spanish court, leaving their forces to hold the Eldorado which had been despoiled by the Chibchas, ransacked by themselves.

We are, therefore, unable to agree with Bandelier when he says that, after this time, "Transplanted by the over-excited imagination of the white men, the vision of the *dorado* appeared, like a mirage, enticing, deceiving, and leading men to destruction on the banks of the Orinoco and the Amazon." The Gilded Man had been located, and that part of the myth was buried. Subsequent explorations were planned to discover rich countries which were Eldorados only in the modern sense of the word; and we find that the word was used with nearly its present signification at the time when the Amazon River received its name. The legend is especially noteworthy in connection with the history of the Venezuelan settlement under the direction of the German Welsers. Having received the province from the Spanish crown practically as a mortgage security for money loaned, Welsch and his associates tried to recover the advances they had made from the revenues of the district; and since the coast lands were found to be less profitable than they had expected, they engaged in one Eldorado expedition after another. Dalfinger, Federmann, and Von Speyer have been mentioned; before the utter ruin and failure of the colony at Coro, Von Hutten's expedition penetrated to Omagua, a region near the Amazon, west of Rio Negro and the Cassiquiare. The Spanish conquerors of Peru and Ecuador were led by the search for further stores of wealth to make the most important geographical discoveries east of the Andes. Gonzalo Pizarro set out from Quito to explore the forests (1539-42), hoping to find spices there, and also "wealthy regions in which the people went around adorned with gold." His lieutenant, Francisco de Orellana, with 53 men in a bark, becoming separated from the main body of the expedition, went on down the Amazon to its mouth. The Dominican Carvajal, Orellana's chronicler, relates that women took part in the fighting against the Spaniards, and that a captive Indian spoke of a tribe of Amazons rich in gold living north of the river. (Compare Prescott's 'Conquest of Peru,' II., 164-5, note). Wandering Indians brought to Peru about the middle of the 16th century reports of countries rich in gold and silver, which lay far eastward; and the viceroy made use of the Eldorado fever thus excited to rid Peru of a large number of disorderly persons. In 1560 a company of criminals and desperados, with women, set out from Santa Cruz de Capacocha, proceeding in boats, canoes, and even upon rafts, down a tributary of the Amazon, under the leadership of Pedro de Ursua. In January, 1561, Ursua was murdered by conspirators, and eventually Aguirre, chief con-

spirator, transformed the remnant of the expedition into a piratical band; captured the island of Margarita, and invaded Venezuela. At least four Eldorado expeditions proceeded from the north coast toward the interior before the end of the century, in addition to that one which Sir Walter Raleigh led in 1595. Consult: Bandelier, 'The Gilded Man' (New York 1893), and Brinton, 'The Myths of the New World' (New York 1868).

MARRION WILCOX.

**Eldridge, Shaler W.**, American abolitionist: b. West Springfield, Mass., 1817; d. Lawrence, Kan., 17 Jan. 1899. He removed to Kansas in 1855, and became proprietor of the American House in Kansas City, soon recognized as the headquarters of Freesoilers. In 1856 Eldridge opened the Free-State Hotel in Lawrence, but soon afterward a pro-slavery court issued a writ of indictment, declaring the place a nuisance, and it was destroyed by a posse led by Sheriff Jones. This occurrence caused great excitement among the Freesoil men, who commissioned Eldridge to visit Washington with a petition in their behalf, and also to sit in the convention that nominated Fremont. Later he became a member of the National Republican Committee and agent to promote immigration into Kansas. Under the last authority he led a large number of settlers to Kansas. During one of these trips, with a party of 350 men, he was taken prisoner by United States troops. Subsequently he recruited a party of Freesoilers, who retook the arms from the United States officers at Leecompton. He was instrumental in giving much aid to the Free-State cause by smuggling large amounts of ammunition and provisions into Kansas Territory. During the Civil War he served in the Union army.

**Eld's Deer**, a deer (*Cervus eldi*) native to the Malayan region. It is about four feet tall, lives in swampy places, and is often found in large herds. Its habits are like those of the Indian swamp-deer. The antlers are peculiar in that the brow-tine sweeps down over the forehead and that the upright part has numerous points.

**Eleanor of Aquitaine**, queen of France and afterward of England: b. 1122; d. Fontevrault, France, 1 April 1204. She was the eldest daughter and heiress of William IX., Duke of Guienne or Aquitaine, and was married 2 Aug. 1137, to Prince Louis, who in the same year succeeded to the throne of France as Louis VII. She was gay, frivolous, a lover of poetry and art, and could not sympathize with the ascetic spirit of her husband. She accompanied him on the second crusade to the Holy Land in 1147. At that time he complained of her preference for other men, and on their return from Asia they were divorced 18 March 1152. A short time afterward she bestowed her hand upon Henry Plantagenet, the future Henry II. of England. This alliance, which made Henry master of Eleanor's vast possessions in France, produced pernicious and protracted wars between France and England. She bore him many children, but his infidelities and neglect changed her love into hatred. She incited her sons Geoffrey and Richard to rebel against their father, was imprisoned in 1174, and remained in confinement until after Henry's death in 1189, when she was released by

## ELEANOR CROSSES — ELECTIONS

his successor, Richard I., who placed her at the head of the government on his departure for the Holy Land. She negotiated his marriage with the daughter of the king of Navarre, and went to Germany with his ransom from captivity. She afterward retired to the abbey of Fontevrault, and surviving Richard, lived to see him succeeded by one of her other sons, John Lackland, the signer of Magna Charta. She was a favorite personage with the troubadour poets of the day, and appears in a very different light in their works from that in which she is represented by French and Norman chroniclers.

**Eleanor Crosses**, memorials of Eleanor of Castile. She was the wife of Edward I. of England, and d. Lincolnshire 1290. Her body was taken to London by her sorrowing husband who subsequently erected a monument, terminating in a cross, at every spot where her funeral train had rested. These places were Lincoln, Grantham, Stamford, Geddington, Northampton, Stony Stratford, Woburn, Dunstable, St. Albans, Waltham, East Cheap, and Charing Cross, but the list varies slightly as given by different authorities. The crosses at Geddington and Waltham remain, although considerably altered by restoration in the latter case. That at Charing Cross, destroyed in 1647, was replaced in 1863 by a new one reproducing the original.

**Eleatics**, ē-lē-āt'iks, a Greek sect, so called because founded at Elea, in Sicily, by Xenophanes of Colophon, about 538 B.C. Zeno, who flourished 464 B.C.; Empedocles, 435 B.C.; and Melissus 428 B.C., were leading philosophers of this school. That which from the commencement distinguished the Eleatic school from the Ionic was its method, which in the one case was dialectic, in the other empirical. Starting from the observation of external nature, the Ionians endeavored to discover some elementary principle, as water, air, fire, or a combination of elements, by the action of which the phenomena they observed might be accounted for. The Eleatics made the abstract idea of Being or God, deduced from the contemplation of the universe as a whole, their starting-point; and their reasonings sometimes led them to deny the reality of external phenomena altogether. This was the result of the development which the principles of Xenophanes received from his followers Parmenides and Zeno, the latter of whom denied the existence of variety in any form, including that of the world and even of movement. See IONIANS; XENOPHANES; ZENO.

**Eleazar**, ēl-ē-ā'zār (Heb. "God hath helped"), the third son of Aaron, and high priest after him (Ex. vi. 23; Num. xx. 25-28). The high priesthood continued in his family through seven generations, till the time of Eli, when we find it transferred to the line of Ithamar. In the reigns of Saul and David it was restored to the line of Eleazar, and so continued till after the captivity.

**Elecampane**, ēl-ē-kām-pān' (*Inula helenium*), a plant of the sunflower family (*Compositæ*). The stem is three or four feet high, thick, pubescent, and branching above; the radical leaves are often two feet or more in length; the flowers are large and yellow. The plant is a native of Europe and Asia, naturalized in the United States. It grows abundantly along roads and in waste places. The root is perennial, and

has a bitter aromatic taste. Elecampane is cultivated occasionally as an ornamental plant, and the flowers are sometimes used to adulterate arnica. The root was formerly much employed in medicine, but has fallen into disuse. It contains a number of active principles, the most important being a volatile oil, inulin, which is a form of starch, and a camphor, helenin. By reason of the camphor and the oil the action of the drug is somewhat stimulant and stomachic. Elecampane was once very much used in the treatment of bronchitis and amenorrhœa. As a hot infusion it subserves practically the same purpose as camomile tea, being a good diaphoretic.

**Election**, a word used in astrology in the plural form, and meaning certain opportunities of times, elected (or chosen) by astrological observations, as most fit for a particular business or enterprise.

In theology, the word (singular) is applied to the act of God in selecting some persons from the race of man to be regenerated by his spirit, to be justified, to be sanctified, and to receive other spiritual gifts in this world, with eternal life in the next. The Calvinistic doctrine makes this election take place by God's mere good pleasure, without any foreseen merit in the individuals chosen. The Arminian one considers that God chooses those who he foresees will accept the offer of the Gospel and act as true Christians till death. The third chapter of the Westminster Confession, entitled "Of God's Eternal Decree," uses more decided language. The strongest adherents of this view are in the Presbyterian churches, though there is a tendency to soften the harsher features of the system. Many Baptists hold the same doctrine, as do the Calvinistic Methodists.

**Elections**. In early colonial days, local officials in New England were chosen in town meeting, much as they are to-day. Nearly all those of the southern colonies were appointed. In New Amsterdam (now New York), the right to elect its own magistrates was long refused by Director Stuyvesant. "If," he said, "the nomination and election of magistrates were to be left to the populace who were the most interested, then each would vote for some one of his own stamp, the thief for a thief, the rogue, the tippler, the smuggler, for a brother in iniquity, that he might enjoy greater latitude in his vices and frauds."

The illicit use of money in elections began almost at the beginning of political history in America. Rhode Island, for instance, found it necessary to pass a general act against bribery and corruption in 1737, and 10 years later replaced it with one even more stringent. Judging by its provisions the evil must have been alarmingly prevalent in that colony. To this day Rhode Island is the New England State where most complaint is made of the same evil. The other New England colonies found no such laws necessary, but all the rest had them save New York and Maryland. In England the purchase of votes was for centuries as natural a thing as the sale of boroughs, and no serious attempt to prevent it was made till 1854, when the Corrupt Practices Prevention Act defined bribery, forbade certain petty expenditures, and required the making public of election expenses of a cer-

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tain character by proper returns. This and further legislation did not remedy the evil materially, and in 1883 a much more drastic measure was adopted, which has been the model for legislation elsewhere. The novel and essential idea in it was the naming of an election agent by each candidate, and the holding of him responsible for publicity as to expenditure. Such American States as have copied this device, have rendered it futile by failing to copy the further proviso found in England, definitely limiting expenditure, with the penalty of invalidation of election in the case of any proved excess. An English candidate standing for a borough of 2,000 electors may not disburse, either by himself or through his agent, a sum exceeding £600; for every additional thousand electors, an extra £30 is permitted. In the counties, where the area is wider and the inevitable expense larger, £650 is the limit for a register of 2,000 electors, with an increase of £60 for every additional thousand. Contrast this with the situation in American congressional districts, where expenditures of from \$10,000 to \$100,000 by candidates are far from unknown. It is estimated that the total party expenditure in the last national campaign was well over \$5,000,000, to which figure it had grown from \$100,000 spent to elect Lincoln in 1864. Add to this the money used for the thousands of candidacies for minor places, and it is clear that the total is so enormous as to make adoption of the complete English reform almost inevitable in the near future, for though a great part of the outgo is for what are conventionally considered legitimate purposes, the mere fact of its size and growth is enough to compel legal limitation if America is not to become a plutocracy. At present a lukewarm public opinion attaches little disgrace to electoral corruption, and easily condones the offense of the public official who indirectly recoups his election expenses out of the public treasury. Therefore, almost in vain do halfway reformers pile penal statute upon penal statute. The Massachusetts law has 56 sections of election penalties, and it is typical. Three years after the passage of the New York Reform-ballot Law in 1890, investigation by a public-spirited committee of 50, together with the finding of more than 60 indictments by the grand jury, demonstrated that false registration, false voting, and bribery were as easily and safely practised as they ever were, and that perjury had enormously increased, owing to the number of safeguards which must be sworn away by the fraudulent voter and the collusive inspector. But deplorable as are all these facts, it is on the other hand true that the great majority of the members of our various legislative bodies, as well as our elected officials, are honestly elected. The diminution of corrupt practices is one of the benefits expected from the use of voting machines. (See **BALLOT**.) False counting of ballots has been an easy and common way to vitiate election results. In many a city ward the election officials return any majority the boss desires. Though the evil has been lessened in some of the States by strict laws, under the strictest of them it is still possible for knavish counters to nullify ballots by adding marks, and the lawmaker cannot keep pace with the shrewdness of the trickster. Furthermore, it is believed that the errors of machinery are likely to be in the aggregate far less damaging

than those made under the present system by the voters themselves. In a contested election case in New York the court estimated that an average of five ballots had been rejected as defective in each election district in the preceding election. In 1895, in the city of New York, out of a total in round numbers of 300,000 votes cast, 9,283 were defective, and 20,400 were blank. Of the 412,319 men who voted in the Massachusetts State election of 1902, 13,630 failed to have a vote for governor recorded, some, no doubt, with intention, but many through carelessness.

Another potent source of election evil is found in faulty methods of identifying the voter. The fraud that results takes the form of "impersonation" (voting on another man's name), or "repeating" (voting more than once). To lessen the likelihood of these crimes, some States require every voter to establish anew each year his right to vote; others allow a name once on the lists to stay there till death or removal causes it to be dropped. With our dread of red tape and formalities, we hesitate to adopt the ultimate remedy, that to be found in France, where every man, as he steps up to the ballot-box, must produce his "electoral card," on which are inscribed his full name, profession, and residence. This card is issued by the mayor of the town where the voter lives, after the latter has established his identity and majority by the production of a properly attested "act of birth." Each electoral card is numbered, and when it is presented at the polls, the judge of elections takes it, and calls off the number and name, while two other judges, with the official poll list before them, repeat aloud the number and name and check off on the register. Then, and not till then, the first judge accepts the ballot from the voter and drops it into the box; and before handing back the card, he tears off a corner of it, which renders it useless for further voting that day. These bits of card are strung on a wire and are counted, at the close of the polls, to see if they tally with the number of ballots in the box. See **BALLOTS**.

Under prevailing methods the views of large numbers of voters are not represented by men of their choosing. Minority parties get a voice in legislative assemblies only by the haphazard preponderance of their members in a few localities. In every voting district that group of electors which is in the minority has no direct representation, and sometimes for a generation its members will go to the polls in vain. Though Norway, in its constitution of 1814, appears to have been the first country to make an attempt to change this, the subject did not attract general attention till toward the middle of the century. In 1844 Thomas Gilpin published in Philadelphia a pamphlet that led a long train of literature, and in 1857 appeared the first of several books by Thomas Hare, in whose idea of "personal representation" J. S. Mill thought he discovered "the greatest improvement of which the system of representative government is capable." Since then many plans to accomplish the same end have been suggested. All presuppose that more than one place is to be filled at a time, as a board of aldermen to be elected on a general list, or several representatives from one district. The simplest plan is the single-vote system, where each elector has but one vote and the

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candidates getting the largest number of votes are declared elected. It has been used in Philadelphia by the Republican party in the election of ward executive committees, and by the Democratic party in choosing inspectors of election. It is the method justified by the theory that no voter is entitled to be represented in any representative body by more than a single representative, and would seem admirably adapted to the conduct of the internal affairs of parties. On the other hand, where the supremacy of party views is the issue, it is manifestly objectionable, as without an impracticable degree of party machinery and discipline, the majority party, if it has nominated as many candidates as there are places to be filled, many so scatter its votes that less than half of them will be elected, and in any event cannot allot its votes so as to make sure of a result proportionate to its preponderance. Systems based on the "limited vote" theory meet this objection to some extent. Under them each voter may vote only for some fixed number of candidates less than the number to be elected. In operation this secures representation to the minority party second in rank, but with no relation to its numerical importance, and smaller minority parties get no representation at all. A modification of the idea was embodied in a law passed by the Massachusetts legislature in 1903, providing that each political party shall nominate 8 candidates for the board of aldermen in Boston; as 13 are to be chosen, this is expected to secure that not more than 8 shall be of any one party. With the next group of systems, those known as "cumulative," arithmetical complications grow. The first practical test of the idea came in 1870, when it was adopted as the method of electing English school boards, and in the same year it was put into the Constitution of Illinois by the proviso that "each voter may cast as many votes for one candidate as there are representatives to be elected, or may distribute the same or equal parts thereof among the candidates as he shall see fit." To each legislative district were allotted three members, so that a voter could cast his three votes for one, a vote and a half for each of two, or one vote for each of three. A mass of testimony on the practical working of the system, collected by M. N. Forney in 1893, indicated that on the whole the people of the State deemed it decidedly advantageous, yet far from perfect. Unquestionably it secures its object, the representation of minorities; in 1892 there was not an Illinois district in which any one party elected all three representatives. The chief objection comes from the chance and temptation for members of the majority to "plump," that is, cast all three votes for one man: sometimes this permits the minority to elect two men, when the bulk of the majority vote is concentrated on one popular candidate; therefore it invites to contests between party colleagues instead of political antagonists, breeds jealousies, and disrupts organizations. These evils have been more conspicuous in the choice of English school boards, for the more men to be elected, the greater the dangers from "plumping." The wasteful accumulation of votes for the more popular candidates or those of the more powerful factions, has permitted small factions to secure the election of members when not really entitled thereto by their numbers, and thus have

let in weak or mischievous men. To guard against this by the *proportional* representation of minorities, systems of three varieties have been devised. The first, known as the "free list" plan, provides that the lists of candidates shall be made up by the parties before the election, and that the seats to be filled shall be divided between the parties in the proportion of the total votes cast by each, the higher men on each list to be declared elected to the number their party proportion warrants. This system has been in use in some of the Swiss cantons, and Belgium enacted it into law in 1899. Its weakness is that it makes election wholly a party matter, practically preventing independent candidacies. A "freer list" plan advocated by William H. Gove of Salem, Mass., provides that the lists shall be made up by the candidates, rather than by the parties. In advance of the election the candidates are to designate who shall get the benefit of any ineffective votes cast for them. When the votes are counted, the first step is to divide the total number of ballots by that of the places to be filled; the quotient determines the number of votes a candidate must get in order to be elected,—his "quota." Votes cast for any one man beyond his "quota" are ineffective, and are ignored, so far as he is concerned, but are to help some other candidate, and the same is true of votes for candidates receiving so small a number that they must fail of election. The "freest list" system, the Hare plan, has the list of preferences made up by neither the party nor the candidate, but by the voter, who designates on his ballot the order of his choice. In the counting, as soon as it appears that a first-choice candidate needs no more votes, the second-choice candidate moves up into his place, getting credited with the ballots until he in turn has reached his quota, and so on. Though advocated by very many able men, from Mill on, the quota plans have as a rule failed to pass beyond the first critical point, legislative comprehension. Like all other plans for minority representation, too, they run counter to the belief, ingrained in Anglo-Saxon communities especially, that only the majority has a right to share in the work of representative government. Furthermore, the English and American adhesion to the two-party idea renders it probable that minority representation will make the more headway among the continental nations, accustomed as they are to government by groups. In America its most promising opportunity is in the choice of local legislative bodies where partisanship on national lines may sometimes disappear.

There is no legal, philological, or popular agreement as to the use of the word "majority" in matters of election. In computation it may mean the amount by which the greater number exceeds the less, if but two numbers are compared; or the amount by which the greatest number exceeds the total of the lesser numbers; or the amount by which the greatest number exceeds the next to the greatest. For the last case we customarily use the word "plurality," but in England the normal designation is "majority," and candidates have been elected with regard only thereto from time immemorial. The weight of American usage restricts "majority" to excess of the greatest number of votes over the total of the rest, and we say that for a majority a total of one more than half is necessary. This prac-



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tice dates from colonial times. In Massachusetts, New York, New Jersey, South Carolina, and Georgia, a majority seems to have been required; in other colonies as a rule a simple plurality sufficed. New York put the plurality rule into her Constitution of 1777, and most of the other States followed her example, but the belief in the virtues of an absolute majority lingered in the New England States till the middle of the following century.

Propositions to go back to the absolute majority plan are now very rarely heard, and in the matter of popular elections the subject still has importance only because the Constitution of the United States requires an absolute majority of electoral votes for the choice of President. In conventions the majority rule yet prevails, occasionally entailing hundreds of ballots, and in the Democratic national conventions a two thirds vote is required to nominate. In primaries and caucuses the plurality plan prevails by almost invariable custom, voters everywhere being unwilling to give the time required for repeated ballots. The courts have had various occasions to consider whether a majority of the votes cast at an election on any question means the majority of those who voted on that question. In 95 U. S. 369 the court held (Miller and Bradley, JJ., dissenting) that "all qualified voters who absent themselves from an election duly called are presumed to assent to the expressed will of the majority of those voting, unless the law providing for the election otherwise declares." But in 69 Ind. 505, where an amendment to the Constitution received less than a majority of all the votes at the election, but a majority of those cast for or against the adoption of the amendment, it was held (two judges dissenting) that the amendment had been neither ratified nor rejected. The celebrated action of Speaker Reed in counting for purposes of a quorum those present and not voting, is of course in line with the theory that a majority of those voting should prevail, and it is significant that his decision, much criticised at the time, has now been accepted by almost everybody as good parliamentary law.

The absence of voters from the polls is a recognized evil, for which the remedy commonly proposed is compulsory voting, secured by imposing penalties for failure to vote. Neither evil nor remedy is novel. In 1636 the general court of the Plymouth Colony provided that "for default in case of appearance at the election without due excuse, each delinquent to be amerced 3s. ster." The custom continued certainly beyond 1671, for in the revision of the laws then published, the fine was put at 10 shillings. Other colonies had like laws, Virginia maintaining hers throughout her history. Her first law on the subject made the fine 100 pounds of tobacco, and in 1662 this was increased to 200 pounds. Some of the New England towns fined freemen who came late to the town meeting. None of the States have revived the colonial idea, of a money fine, probably because the evil is diminishing, rather than increasing. It is of comparatively small moment now in our presidential elections, where five sixths of the voters take part, and the absence of a large share of the remaining sixth can be accounted for by sickness, age, accident, inclement weather, and other reasonable excuses, but it is still of unfortunate importance in State

and municipal elections, though even there diminishing. In Belgium, Switzerland, and some other European countries, punishments are inflicted on non-voters. In Belgium, for the first offense the culprit is at once cited to appear before a justice, who reprimands or fines him; the second offense is more severely punished, and the name of the refractory citizen is published by the magistrate and posted on the gates of the town hall. The man who, without excuse, has abstained from voting 4 times in 10 years is considered unworthy of citizenship; his name is stricken from the poll lists, and for 10 subsequent years he is debarred from holding any public office. Illinois has an ingenious penalty, putting on the jury lists the names of persons who fail to vote. It might be expected that this would benefit the suffrage more than the jury system. One of the proposed forms of punishment is that the voter who once omits to vote shall not be allowed to vote thereafter until he shall have purged himself by paying a fine, but this would be no hardship to most of the apathetic citizens.

Besides the specific remedies in process of application or proposed for the cure of the evils our methods of election have developed, there are general reforms of many kinds with this as their purpose in whole or in part. One of them is the movement for lessening election evil by lessening elections, which has prevailed in nearly all the States to the extent at least of substituting biennial for annual elections. Another seeks improvement by having State and municipal elections on different days, and New York has gone so far as to put them in different years. Another, applicable only to municipal elections, looks to the abolition of national party lines in local affairs. Still another finds promise in the reduction of the number of elective offices. (As to the methods of nominating candidates, see CAUCUS; and for further information upon this subject, see BALLOT; POLITICS; etc.)

*Bibliography.*—Bishop, 'History of Elections in the American Colonies' (1894); Dallinger, 'Nominations for Elective Office in the United States' (1897); Meyer, 'Nominating Systems' (1902); Ostrogorski, 'Democracy and Organization of Political Parties' (1902); Wigmore, 'Australian Ballot System' (1889).

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**Elective Affinity**, a term formerly used in chemistry, in connection with the supposed fact that when a given chemical substance is mixed with two or more others with which it is capable of combining, it will exhibit a preferential affinity for one of them, and combine with that to the exclusion of the others. This view of chemical action is now known to be incorrect. See EQUILIBRIUM, CHEMICAL.

**Elective Courses and Elective Studies**, as applied to colleges and universities in particular, and to all schools in general, may be defined broadly as that system of education which permits the student or learner to choose his own subjects of study during the time of attendance at school. The matter of allowing more latitude of choice to the individual pupil has attracted much attention in recent years, with the result that many radical changes have been



## ELECTORAL COLLEGE—ELECTORAL COMMISSION

made in the courses of study in some of the colleges and universities in the United States. Formerly Harvard, Yale, and other American schools required that students should pursue certain studies in order to obtain the degree of bachelor of arts; and such restriction eventually led to the exclusion of all studies that did not contribute to the obtaining of the desired degree. Gradually the secondary schools adopted compulsory courses of study preparatory for colleges, and crowded out many of the studies that might fit the student for business life without going the college road. The special commercial, scientific, and art school came into existence to meet the wants and needs of a large number of students. Many of the leading schools of the United States have in recent years modified their courses of study, and to-day allow a choice of subjects. The new colleges, Leland Stanford, Jr., Chicago, Cornell, and others, have allowed from the first more freedom in the selection of subjects than was formerly permitted by the other schools. The "optional" or the "elective" system is not new; it was in existence in many of the leading schools in Mediaeval Ages and even earlier, and success and failure have attended the system according to the methods used in its enforcement. The strongest and best work in any school has been done where the needs of the individual have been taken into consideration. Where able instructors, those who understood human nature and its needs, have guided the immature student, or to use the modern term, where there were wise "advisers," the system was a success. The importance of the adviser is shown in the marvelous results accomplished by the independent schools which came into existence in the United States, especially in the West, about the middle of the 19th century. Thousands attended those schools, and with good results, because wisely directed and guided by capable, conscientious advisers. The pupil when left to his own discretion may choose studies "along the lines of least resistance," or "soft" courses, and may not select the studies necessary for the foundation of any system of education. Students of the maturity of mind required for entrance to Johns Hopkins or similar institutions cannot be compared with the younger pupils who constitute the freshman classes of the majority of our colleges. In order to ascertain what colleges and universities sanction elective courses it is necessary to obtain the latest changes direct from the college authorities. Consult: Burns, 'Elective System of Studies in Colleges' ('Catholic World,' Vol. LXXI., 366); Eliot, 'Educational Reform' (1898); Hanus, 'Problem of Electives' ('Popular Science Monthly,' Vol. LVIII., 58); Phillips, 'Electives in American Education' ('Pedagogical Seminary,' Vol. VIII., 206); Shaler, Thurber, and others, 'Elective Studies in Secondary Schools' ('Educational Review,' Vol. XV., 417); Thurber, 'Some Problems of the Elective System' ('School Review,' Vol. IX., 79).

**Electoral College.** See ELECTORS.

**Electoral Commission, 1877.** The electoral vote in the presidential election of 1876 showed 184 undisputed votes for Tilden; 163 for Hayes; four States with 23 votes—South Carolina, 7; Florida, 4; Louisiana, 8; Oregon, 3—sent in conflicting returns. If the Republicans

won all the contests, Hayes was elected by one vote. Of these States, the first three returned popular majorities for Tilden electors; but the "carpet-bag" governments in each had constituted "returning boards," whose function was to throw out enough Democratic votes, on the ground of intimidation of negro voters, to leave a Republican majority. Neither the reality of the intimidation, nor the arbitrariness of the assumption that but for it the negroes would all have voted and all voted Republican, is now disputed by either party. Oregon chose Hayes electors; but as the returning boards would give the Republicans the other three States, and therewith the election if upheld, the Democrats ousted a Hayes elector on a technicality and replaced him by a Tilden one, as a basis of compromise or a menace. Obviously, the Republicans could not compromise anything and win; and as they held the administration and the army, they could defy threats. The Senate was Republican, the House Democratic; there was therefore a deadlock on the admission of returns, as the 22nd Joint Rule, throwing out disputed States, had been repealed by the Senate 20 January for this very emergency. Finally, as an alternative to a most dangerous anarchy, both sides agreed on a joint commission to pass on all the contests; the Democrats being confident that it could establish no guiding principle whatever, of going behind the returns or not, accepting or rejecting State certificates as conclusive, which would not give them at least one of the disputed States. They underestimated the intellectual resources of their opponents. The Act creating the commission was approved 29 Jan. 1877; its decisions could only be reversed by concurrent action of both Houses. The body was to be composed of five members of each House and five associate justices of the Supreme Court; the latter as indicated were two Republicans and two Democrats, and were to select a fifth. The Senate appointed three Republicans,—G. F. Edmunds of Vermont, O. P. Morton of Indiana, and F. T. Frelinghuysen of New Jersey; and two Democrats,—T. F. Bayard of Delaware, and A. G. Thurman of Ohio, the latter taken sick and replaced by Francis Kernan of New York. The House appointed three Democrats,—H. B. Payne of Ohio, Eppa Hunton of Virginia, and J. G. Abbott of Massachusetts; and two Republicans,—J. A. Garfield of Ohio, and G. F. Hoar of Massachusetts. Obviously, therefore, the odd justice would have the deciding voice. The Republican judges were William Strong and Samuel F. Miller; the Democratic, Nathan Clifford and Stephen J. Field; they chose Joseph P. Bradley as the fifth. The counsel were—Democratic, Charles O'Connor of New York, Jeremiah S. Black of Pennsylvania, Lyman Trumbull of Illinois, R. T. Merrick of the District of Columbia, Ashbel Green of New Jersey, Matthew H. Carpenter of Wisconsin, George Hoadley of Ohio, W. C. Whitney of New York; Republican, W. M. Evarts and E. W. Stoughton of New York, Stanley Matthews and Samuel Shellabarger of Ohio. Other lawyers appeared on special points. The States were taken up in alphabetical order,—Florida, Louisiana, Oregon, South Carolina,—and the vote upon each was eight to seven for the Republicans, on every contested point, Mr. Justice Bradley sustaining all the contentions of that side. The broad decision was, that Congress cannot, as it had done re-

## ELECTORAL REFORM — ELECTORS

peatedly before, go behind the returns and take evidence as to the manner in which State majorities for electors have been obtained. On other points the decisions varied with the cases. In particular, the Democrats contended that the question as to the eligibility of an elector who is also a government official—a combination forbidden by the Constitution—was decided in two different ways within two days, on the Florida and Louisiana cases, in both to the profit of the Republicans; and Judge Bradley published a defense of his action. The court adjourned *sine die* on 2 March. The peaceful acceptance of the decision was much helped by the Democratic speaker, Randall of Pennsylvania, who firmly checked all Democratic attempts to "filibuster."

**Electoral Reform.** See ELECTIONS.

**Electoral Votes**, the votes cast by the presidential electors or electoral college for President and Vice-President. Prior to 1804 each elector voted for two candidates for President. The one who received the largest number of votes was declared President; and the one receiving the second largest vote, was elected Vice-President. The votes for the first President were: George Washington 69; John Adams (Mass.) 34, John Jay (N. Y.) 9, R. H. Harrison (Md.) 6, Jno. Rutledge (S. C.) 6, John Hancock (Mass.) 4, Geo. Clinton (N. Y.) 3, and scattering 7. In 1900 the electoral votes cast by the electoral college were as follows: For President, William McKinley, 292; William J. Bryan, 155; for Vice-President, Theodore Roosevelt, 292; Adlai E. Stevenson, 155. See ELECTORS; ELECTORAL COMMISSION.

**Electors, German Imperial** (Ger. Kurfürst), certain princes of the old German empire who had the right of electing the emperors. The number of the electors was early fixed at seven, including the archbishops of Mainz, Cologne and Trèves, the king of Bohemia, the count palatine of the Rhine, the duke of Saxony, and the margrave of Brandenburg. Later, electorates were given to Bavaria and to Hanover; in 1802 the Bavarian electorship had expired, the archbishops of Cologne and Trèves were excluded, and the number of electors was increased to 10 by conferring the rank on the rulers of Baden, Württemberg, Hesse-Cassel, and Salzburg. In 1806 the emperor gave up the imperial title, and the electors gradually adopted other titles.

**Electors, United States Presidential** (as a body, termed the Electoral College, a term informally used since about 1821, probably suggested by the college of cardinals; "college of electors" appears in the Act of 1845), the intermediate body for whom, and not directly for President and Vice-President, votes are cast every four years. When constituted, they were meant to be a council of the ablest men in the country, exercising an independent choice of the chief executive. The theory has never been fact for a moment, and since the third election not even a pretense; the institution is retained for very different reasons, and perhaps stronger ones. As a fact, the electors are only registers of the already pronounced party choice in candidates, and accept the officer under a solemn tacit pledge to act only as such. They are State bodies, and their integrity as such is

scrupulously guarded. They consist of as many members as the State's representation in both Houses of Congress; therefore a State cannot have less than three, and New York has 39. Their method of appointment is left absolutely to the State legislatures. Till about 1820-4 they were appointed direct by the legislature in most States; in 1824 popular election had superseded it in all but six, and by 1828 in all but one,—South Carolina, which retained it till 1868. The district system, which divides the State's electoral vote, has sometimes been tried as a party compromise; but at present all parties prefer the system of having all the electors on a general ticket. The State appoints the place of their meeting; Congress has fixed the time,—the second Monday in January,—to prevent a failure of any meeting through the refusal of a minority house of a legislature to join with the majority house in setting a date. The State, by act of 3 Feb. 1887, is made absolute judge of all disputes over appointment or returns; its certificate is decisive between two sets of returns, and Congress can only intervene if the State itself is unable to decide. But what is the State? This was precisely one of the questions before the Electoral Commission (q.v.), and even the new act would seem to leave room for party decision as there; and no Electoral Commission would ever be possible again. In case of vacancy in the electoral body, by death, resignation, refusal to serve, or any other cause, the State may pass laws to fill it; if it has no such law, that vote is lost, as happened in Nevada in 1864.

At their meeting, no organization is required; but it is customary to organize and elect a chairman. They then cast separate ballots (which remain the property of the State) for a President and Vice-President. In the first three elections, each simply voted (as required by the Constitution) for two persons, one a resident of a different State, without designating the office; the one with the highest vote became President, the next highest Vice-President. Obviously, as soon as parties gained firm organization, mere party loyalty would invariably produce a tie; and in 1800 Jefferson and Burr were so tied (see JEFFERSON-BURR IMBROGLIO), the resulting scandal and danger leading to the Twelfth Amendment, which obliges them to designate the office voted for. After voting, they make three lists of the persons, offices, and number of votes, and the names of the State electors certified by the "executive authority" of the State; seal them, and certify each; transmit two to the President of the Senate, one by messenger and one by mail, and deposit the third with the federal judge of the district. They have then no further functions.

On the second Wednesday in February, in the Representatives Hall and in presence of both Houses of Congress assembled, the president of the Senate opens and counts the State returns, and announces the result. In case of a tie the House decides by a majority of States, each having one vote; on a tie for Vice-President, the Senate decides in the same way. If no one candidate has a majority, the Houses decide in the same manner, choosing from the three highest candidates on the list. Thus, in 1824 John Quincy Adams was elected President by the House; in 1837 Richard M. Johnson was

## ELECTRA — ELECTRICAL ENGINEERING

elected Vice-President by the Senate. But suppose the third and fourth are ties. This quite probable contingency has not been provided for, and may cause trouble. There was formerly a custom, when a State sent in conflicting electoral returns, of announcing the final result "in the alternative"—so many votes with, so many without, the disputed returns; but the Act of 1887 ends this, and it was always unworkable where the disputed votes were vital to the election. By the 22nd Joint Rule of Congress up to 1876, in case of dispute the returns from that State were thrown out, but in anticipation of the struggle over the returning boards, the Republican Senate on 20 Jan. 1876 repealed the rule.

The electoral system, despite its utter theoretic absurdity and undemocratic character, is never seriously menaced, because of its great practical utility in settling the presidential question at once on the counting of State votes. With direct popular vote, where parties are closely balanced, the result could not be known perhaps for months, and then might depend on a few thousand votes in a half-lawless district; fraud and violence would have infinite possibilities, and we should be on the verge of civil war every few years. The danger of the district system, often proposed, is the certainty of the districts being gerrymandered.

**Electra**, in Greek legend, the name of several personages. (1) One of the Oceanides, wife of Atlas, and mother of Dardanus by Zeus. (2) A daughter of Atlas and Pleione, who became one of the Pleiades. (3) A daughter of Agamemnon, king of Argos, who incited her brother Orestes to avenge their father's death by killing their mother, Clytemnestra. Orestes gave her in marriage to his friend, Pylades, and she became the mother of Strophius and Medon. She is the subject of a number of dramas, both ancient and modern.

**Electrepeter**, ē-lek-trep'e-tēr, in electricity, an instrument for changing the direction of electric currents.

**Electric Action**, in organ building, a mechanism in which the connection between the key-board and the pipes is made by the help of electricity. See **ORGAN**.

**Electric Alarm**, or **Thermostat**, an instrument used for giving an alarm when the temperature rises to a point at which the instrument completes the circuit. This is used in stoves and hothouses, to indicate excess or lack of temperature, and as a maximum thermometer alarm or fire-alarm. See **ELECTRIC SIGNALING**.

**Electrical Diapason**, a small instrument like a tuning fork, the vibration of which is maintained by means of electricity.

**Electrical Education**. See **EDUCATION, SCIENTIFIC AND TECHNICAL**; **ELECTRICAL ENGINEERING**.

**Electrical Endosmosis**. See **ENDOSMOSIS**.

**Electrical Engineering**. Electrical engineering is probably the youngest of all the professions, for it has hardly been recognized as a regular profession for more than 15 years past. As a result, the men who have reached prominence in it to-day have attained their positions from widely differing courses of preliminary training; many of them are men who started life in other lines of work and after-

ward turned to electrical pursuits on account of the sudden growth and importance of the business. In consequence of this, all methods of preliminary education are represented and their relative values can be estimated. The argument runs largely between two classes of men,—one represented by the so-called "practical man" and the other by the theoretical electrician; the graduate of the machine shop and the graduate of the university. Both of these types have attained success, but the correct answer to the argument will probably be found in a proper combination of the two types. In the past some of the most successful electrical engineers have belonged distinctly to the class of practical men with little theoretical training, but the conditions have changed. In the early days of the profession, there was little theory or predetermination of results and work was carried on largely by guesswork or by cut and dried approximations. At the present time, however, such a state of development has been reached that exactness of result is essential to success and work based upon exact theory becomes imperative. In a stationary condition of an art a man with practical experience only may become very familiar with all the existing types of apparatus and, knowing their various applications, may qualify, to an extent, as an engineer. But the extraordinarily rapid growth of the electrical arts places electrical engineering apart from all the other engineering branches, for new discoveries and theories make radical changes from year to year in the construction and operation of electrical machinery. The engineer whose education is based only upon practical experience cannot keep up with the progress and change resulting from it, and falls behind; whereas, the man with knowledge of the theory, and a mind trained by the theoretical studies and scientific reasoning, easily grasps the theory of the change and readjusts his mind to the new without difficulty or delay. Many instances can be cited of men who have been prominent as electrical engineers, who have been dropped out of place in the course of the rapid progress which has been made, on account of a lack of theoretical foundation in their knowledge. Those who have retained their positions throughout the growth of the art have done so by persistent study along theoretical lines.

In its present state electrical engineering is the most scientific of all engineering professions. A man must be to a great extent a physicist, a chemist, and a mathematician, as well as be familiar with machinery and its design, in order to be a worker in the broadest field. Many of the problems connected with other branches of engineering can be solved by common sense and by one's sense of proportion as guided by experience and by the eye. But most of the problems in electricity are invisible, so to speak, and can be understood only through their expression in the form of symbols. Probably no one will dispute to-day that the preliminary education of an electrical engineer demands a special training in those theoretical branches, mathematics, physics, chemistry, and mechanics, sufficient to train his mind into accurate methods of thought and reasoning and to supply him with the actual technical information which he will need in the practice of his profession. But theory alone is not all. The human mind is such that it works with difficulty in pure theory without a series

## ELECTRICAL MANUFACTURING INTERESTS

of mental pictures to fix and co-ordinate the ideas, and the study of theory is likely to make little lasting impression unless the physical meaning of the theory is brought out by constant association with actual apparatus which demonstrates the application of the physical law. The best course of training for an electrical engineer would seem to be a broad course of education in general subjects at the preparatory school before entering college, with practical work, if possible, along lines of simple mechanics, such as carpentry, in order to train the mind into a sense of proportion and the relations of parts, which is the basis of all engineering. Next, a college course with general subjects the first year, and afterward, for the remaining years of the course, those general and theoretical subjects which have a direct bearing upon the practice of the electrical profession, such as mathematics, mechanics, physics, chemistry, theoretical electricity, and magnetism and thermodynamics. This should be supplemented by actual daily practical work with machinery operating by the principles covered by the theory studied and demonstrating all the phenomena incident to the theory. After graduation an apprentice course should be pursued in some large electrical manufacturing establishment where the commercial relations of the knowledge acquired in college can be clearly set forth. Large machines can be operated which are not available at a college and experience in the installation of large plants can be obtained, and experience gained in the designing departments where all kinds of commercial apparatus are laid out.

After a few years of this training, specialization may begin along the lines selected for the life work but preferably not before. A man makes a mistake to consider himself a qualified electrical engineer after he has been graduated from college, for he is not one. His mind has been trained into a condition where he can readily absorb the principles of the electrical profession, but that is all, and the subsequent apprentice training is as important as the college course, in order to acquire the broad viewpoint from which to make the correct start in the direction in which a man is best fitted. It perhaps means a smaller income the year after graduation from college, but it means much more at the end of five years. But theory and practice are not the only elements necessary for the successful engineer. There are many qualities required in common with other professions; executive ability, business knowledge, presence of mind and ability to handle men, nerve and resourcefulness in handling machinery in times of emergency, are all necessary to the successful engineer. These elements cannot be ac-

quired in the study of theory and practice alone, and many men who have stood high in their college courses have failed afterward in the practice of their profession because of a lack of these qualities. The study of chemistry becomes more and more important as the profession advances, for the branch of electro-chemistry is rapidly developing and is likely to become one of the largest fields in the application of electrical science. And almost above all comes a training in the English language. No man who cannot express himself clearly and concisely in writing or in conversation can hope to attain a prominent position in his profession. The education of an electrical engineer, however, must never be considered as completed. The art advances so rapidly that constant study is necessary, even to keep up with the progress of the times. But an electrical engineer should be willing to do more than this. He should study to keep ahead of progress and do his share toward the instruction of others.

H. W. BUCK,  
*Electrical Engineer.*

**Electrical Manufacturing Interests.** A few pieces of experimental electrical apparatus were the entire product of electrical machinery between 1800 and 1825 and constituted the bases from which later inventions and developments dated. Only within the last 50 years when the correlation of electricity and magnetism was fairly understood, and the ability to turn mechanical energy into current fully perceived, did there come in quick succession telegraphy, electroplating, electric lighting, telephony, electric power, electric traction, electric heating, forging, welding, and cooling and the electric extraction of minerals and precious metals. In the promise of the future, electricity now associated with intense and crowded city life is likely to be the agency chiefly to be relied upon in the closer knitting together of city and country, the increasing of facilities for commerce, and the diffusion of information throughout remote districts.

The telegraph, representing a pioneer electrical development, has not yet attained the magnitude of maturity. Inclusive of allied and similar services to the public, the telegraph system of the United States reaches a capitalization of about \$250,000,000, of which the Western Union and Postal lines may be credited with more than one half. The condition of the telegraph industry in the United States and Europe is portrayed in the following figures:

The telegraph systems of Europe are all conducted by the government of each country, and are almost bankrupt, as compared with

STATISTICS OF EUROPEAN AND AMERICAN TELEGRAPHS.

DIVISIONS	Population	Miles of Line	Miles of Wire	Offices	Messages	Receipts	Cost of Maintenance	Area in Square Miles
Europe Including Asiatic Russia, Egypt, Al- geria, etc.	393,178,871	425,600	1,585,267	76,764	258,584,166	47,542,222	25,393,342	10,886,619
United States Western Union & Postal only	75,997,687	222,587	1,118,086	25,609	79,696,227	Western Union only 24,758,569	Western Union only 18,593,205	3,092,679

## ELECTRICAL MANUFACTURING INTERESTS

the economic success of the private enterprises in America. It may be added that the great and small steam railroads in America also maintain their own telegraph service. That of the New York Central costs \$300,000 a year.

As for telephony, the advent of Prof. Bell's telephone in 1876 found capital quite averse to assuming any risk in it, and even in 1879 the Western Union Telegraph Company surrendered all its telephonic work to the American Bell Telephone Company, on condition of being paid for a term of years 20 per cent commission on the receipts in royalties from the telephone, which brought about \$7,000,000 into the Western Union treasury. But the telephone has meantime gained ground so enormously that some observers believe the effectual supersession of the telegraph to be well in sight. The American people now exchange yearly not far from 3,000,000,000 telephonic talks; that is, they use the telephone 30 times as much as they do the telegraph, at infinitely less cost.

The capitalized value of the telephone business of the United States is estimated between \$400,000,000 and \$500,000,000; of which about \$125,000,000 represented in 1901 the American Telephone & Telegraph Company (Bell system), then operating through about two score sub-companies which had expended nearly \$170,000,000 in building up a system of 1,348 exchanges with 800,000 subscribers and handled 1,825,000,000 exchange connections a year. Owing to the expiration of the fundamental telephone patents, however, about 5,000 "independent" local telephone exchanges, outside the Bell system, and using the apparatus of as many as three score manufacturers, sprang into being. They probably have not less than 750,000 subscribers. A large amount of "interior" telephone work has been done of late years for factories, mills, hotels, and apartment houses. Farmers have particularly benefited by the "independent" movement, and have largely participated in it on the co-operative plan. As compared with Europe, the United States show a remarkable preponderance in the use of the telephone. As against 1,500,000 subscribers in this country, Germany has 229,391 stations; Great Britain, 171,660; Sweden, 73,500; France, 59,927; Switzerland, 38,864; Austria, 32,255; Norway, 29,446; Russia, 31,376. It is often claimed that service is cheaper in Europe than here. Superficially considered, this may be true, but it is quite erroneous when the quality of service is taken into account. Under the present competitive conditions, telephony is being remarkably cheapened in America, and the industry is growing at a rate beyond all parallel. See TELEPHONE.

Fire-alarm telegraphs have been an important item in this field of manufacture, and the Gamewell system is perhaps the best known. At the present time about 800 cities have fire-alarm telegraph systems. Every city has now its police telegraph also, many combining with it a telephonic patrol system that brings a squad to any point within five minutes after the call is sent in. The district messenger system has become familiar in most American cities, as an auxiliary to the telegraph. In New York the average number of boys employed for this work was recently estimated at 1,200, who ran some 2,500,000 errands in a year. See ELECTRIC SIGNALING.

As an offset, perhaps, to the European pre-

eminence in the one department of submarine telegraphy, we may turn to the generous figures of the growth of electric lighting in the United States. There are about 3,000 local electric-light companies here, and some 500 municipal plants. The investment in central stations and isolated plants is placed at \$1,000,000,000. Of isolated plants for arc or incandescent lighting in mills, mines, stores, halls, docks, etc., the number in the United States has reached not less than 10,000; there were in 1893 no fewer than 3,500 such isolated incandescent plants, which had a capacity of 1,500,000 lamps. All this is the outcome of the inventions of Edison, Brush, Elihu Thomson, Weston, Wood, Hochhausen, and, in the new era just beginning, Nikola Tesla, Stanley, Bradley, and Steinmetz. At one time some 40 or 50 manufacturing companies competed for the sale of the plant; but the art has in many respects become specialized.

There are now in the United States about 500,000 arc lights and perhaps not less than 30,000,000 incandescent, large numbers of the arcs being of the "enclosed" type, a comparatively recent introduction. Of late years there has been a steady growth in the use of electric motors deriving current from central station circuits, and using about \$10,000,000 worth of current a year. Hundreds of industrial establishments have power-plants of their own, and thousands of motors, replacing steam and other engines. Within the past few years, electric power transmission also has grown wonderfully, and the investment in that field alone is estimated at \$100,000,000. Many transmission plants are associated with electric lighting and street railway enterprises; others are for mining operations or for industrial purposes in general. The most striking plants in the world for power transmission are found on the Pacific slope. One of them, that of the Bay Counties Company in California, is now sending power in large quantities electrically from Colgate to San José, a distance of 184 miles. One of its circuits crosses the Strait of Carqueinez in a single span 4,427 feet long. On one section of its line, 142 miles in length, a pressure of 40,000 volts is used, and this is now being increased to 60,000 volts. The great utilization of Niagara electrically is familiar to all. There are probably between 600 and 700 electrical manufacturing concerns in the United States, varying greatly in size. As to light and power, one company making apparatus for these uses alone had sales in 1900 of \$28,783,000, and more than 12,000 employees working in three main factories, which have nearly 2,500,000 square feet of floor space.

Electric railroading was the object of much experiment. The work of Thomas Davenport, a Vermont blacksmith, in the fifties, embodied many of the elements familiar in the street-railway of to-day; but no progress was made, because the primary battery was then the sole source of current. Within the last 15 years the electric railway industry was thoroughly established through the inventions of Sprague, Van Depoell, Henry, Daft, Field, and others. In 1887 there were only 13 small roads. With the year ending June 1901 the trolley systems in the United States reached the total of 905, with 19,314 miles of track, 55,000 cars, and a capitalization of fully \$1,750,000,000, which in spite of frequent inflation has a notable dividend-earning capacity, rarely



## ELECTRICAL MANUFACTURING INTERESTS

falling below 6 per cent for the bonds, and the common stock receiving as much. The ability of electricity to increase the traffic of a street-railway has hardly ever been less than 40 per cent in the year of its adoption, and has frequently exceeded 100 per cent. The annual increase in the number of electric railways in America long equaled the entire number in Europe, averaging about 100. This increase represents a purchase of some \$100,000,000 worth of rails, cars, motors, wire, engines, boilers, poles, etc. This particular industry has endless aspects. In New York, Washington, and Chicago, underground trolley-conduit roads are being adopted instead of the overhead trolley type, with great success. In Chicago, at the World's Fair, an elevated electric road carried 8,000,000 passengers, and there is now a similar road in regular operation in that city. In New York the tunnel electric-railway system, to cost the metropolitan taxpayers \$50,000,000, is on the plan so successful for some years past in London, and the Manhattan Elevated system in New York is spending millions of dollars on an electrical equipment for all its cars. More interesting still is the inter-urban extension of the trolley system. Some of these country roads are hundreds of miles in length. The competition of these roads and the regular street trolley railways with steam railroads has begun to revolutionize the latter, because 10 miles for 5 cents is an ordinary car trip, and the steam train needs 10 cents for 5 miles for its maintenance. On some steam roads the suburban travel has been practically wiped out, and a great many schedules have been abandoned. To meet this serious condition of affairs the Pennsylvania, and the New York, New Haven & Hartford railroads, among others, have adopted electricity for some of their branches with marked success; and the intention is to carry this change much farther at once, a marked instance being the projected use of electricity in bringing trains on the New York Central system through the outlying parts of the city into the Grand Central Depot. Additional to this is the use of heavy 1,500 horsepower electric locomotives by the Baltimore & Ohio Railroad Company for freight haulage in its Baltimore tunnel. These locomotives haul trains of 1,400 tons, and make, when necessary, a speed of 60 miles an hour. In short, the steam railroad system is at the point of a new departure, and is everywhere being prepared for the greater utilization of electricity.

An art allied to electric locomotion is that of electric navigation. At the World's Fair in Chicago in 1893, 1,003,500 passengers were carried on the lagoons by a fleet of 50 electric launches; and these boats, scattered all over the country, have become nuclei for a number of smaller fleets employed by trolley railways, park boards, police departments, and private owners. These boats are operated by means of storage batteries, charged from time to time, and able to run them continuously for 40 or 50 miles. A boat of such a character, 35 feet in length and 6 to 8 feet beam, making 10 to 12 miles an hour, is obtainable complete for about \$1,600.

The storage battery has been more successful afloat than in street-car propulsion, but is now rapidly coming into use for isolated plants, street railways and central stations, chiefly as a reservoir of current when the machinery is not in

operation. During 1900, one storage-battery company filled orders for \$3,500,000 of plates, and shipped 11,688,151 pounds of plate for various types of cells. It is becoming the practice, also, to equip fire-alarm departments with storage batteries in place of the old primary batteries. See ELECTRIC STORAGE BATTERY.

Electric mining is one of the latest of the industries to be developed by the electrical engineer, and bids fair to surpass the electric railway in magnitude. The demand for apparatus in it is estimated to have passed already \$100,000,000 for hoists, crushers, drills, pumps, ventilators, cars, etc. The adoption of this machinery, furnished with current from dynamos driven by water-power, has enabled scores of mines to pay expenses that were unable to do so with fuel as high as \$15 a ton. Some of these plants are being operated at altitudes of 12,000 feet above sea-level, and exemplify the beauties of long-distance electrical power transmission, in itself now a separate field of endeavor.

A recent development of traction work has been found in "telpherage," the invention of the English scientist, Fleeming Jenkin. Small electric motors travel along aerial wires, hauling loads after them in receptacles suspended below them. In this manner tracks are dispensed with, lines of transportation can be run across rivers, farms, plantations, etc., and produce carried to market, or supplies distributed from a common centre. The system is analogous to that of cable haulage, already abandoned in street-car work. The handy little motor is fed with current from the wire, which is both conductor of electricity and a track. Several telpherage plants have recently been installed, one of them being sent to Cuba. But for the fact that our own markets have had so large a capacity of consumption, an enormous export trade in American electrical apparatus would have grown up long ago. As it is, the demand from foreign countries in certain lines is already respectable. American electrical apparatus finds a market throughout the entire globe, not only in such new civilizations as Japan, China, and Korea, but in England, and Europe. At the present moment, London has in operation a most successful underground road, equipped with American apparatus, and C. T. Yerkes, an American, is reorganizing, electrically, the old Metropolitan underground system. Indeed, if the remark of Emerson be true, that steam is half an Englishman, we may with equal felicity assert that electricity is nine tenths an American.

The above are to-day the main lines of American electrical manufacturing and supply of current, reaching toward a capital of \$3,000,000,000; but they are not all, and they draw their material from many subsidiary industries. The electric refining of metals is a growing department, in which millions are invested annually. The returns of 1899-1900 show that in copper treatment alone, some 200,000 tons of "electrolyte" are now produced annually in the United States, with 170,000 ounces of gold, and 21,000,000 ounces of silver as by-products. Electricity is also being used for the production of large quantities of aluminum, graphite, carborundum, and calcium carbide. There were in 1895, 392 electroplating establishments in the United States, with a capital of \$38,000,000, employing 2,700 hands; and there were also no fewer than 300 electrotyping



## ELECTRICAL MORTAR—ELECTRIC ALTERNATING CURRENTS

firms, besides large numbers of etching and jewelry houses using current in their work. The insulated wire and cable factories number a dozen. Their output mounts into countless millions of feet of wire annually, while the practice of running interior wires through tubes has necessitated the production of some 45,000,000 feet of insulated conduit annually. Merely placing wires underground is estimated to have required \$150,000,000 for cables and subways. Every hotel in the country has its annunciator system, and every private residence of any pretension has at least its electric bells. In medicine, electrotherapy is so well recognized that a score of large manufacturers are busy turning out galvanic and faradic apparatus for practitioners of all schools. The production of disinfectants electrically has assumed large proportions, and their use is growing. The place of electricity in education may be gauged by the fact that more than 1,500 students take up electrical engineering in a single year as a special study at leading colleges. It is seen clearly to-day that the future of all the electrical arts depends upon a reduction in the cost of current, and to this end Nikola Tesla (q.v.) has suggested many novel and ingenious schemes. Others are working at the problem of obtaining electricity directly from heat; and the future seems big with promise.

T. C. MARTIN,

*Editor The Electrical Engineer.*

**Electrical Mortar**, a small mortar in which is placed a discharge to take place between two bodies of contrary electricities. The discharge is so instant as to expel a light ball placed in the mouth of the mortar.

**Electric Alternating Currents.** A loop of wire, revolving between two magnet poles of opposite polarity, is the simplest form of an alternating current generator. The direction of induced electromotive force in the two halves of the loop, which cut the magnetic flux in opposite directions, is such that the combined electromotive force at the terminals is double that of either revolving conductor alone. This induced electromotive force is proportional to the rate of cutting the magnetic lines, and therefore to the sine of the angle by which the plane of the coil differs from the plane midway between the poles and normal to the magnetic flux. At its zero position, or when the planes coincide, the coil is cutting no lines of force and we have  $\sin \alpha = 0$ . The electromotive force, however, grows as we depart from this zero position, assuming uniform speed, until, when  $90^\circ$  is reached the rate of cutting of the lines becomes a maximum,  $\sin 90^\circ = 1$ . Passing on, the electromotive force dies away until  $180^\circ$  is reached, when the value again is zero. From this to  $270^\circ$  we have an increasing electromotive force, but of opposite polarity and at the end of the revolution, or  $360^\circ$ , again reach zero. Thus we have in one revolution in a two-pole field, two waves of pressure of the same form but of opposite sign. The one is called the positive wave and the other the negative. One such revolution, or one positive wave and one negative wave, constitute what is called a cycle, or period. The periodicity of modern alternators varies from 133 cycles to 15 cycles per second. The great majority of systems have a frequency between  $60\sim$  and  $25\sim$ . Both of these frequencies

are standard practice in this country, and the values between are chosen for special cases. Owing to the high frequency of commercial systems, alternators are built with more than one pair of poles, in order to keep the revolving speed within reasonable limits.

**Average and Effective Values.**—If we plot the values of the instantaneous pressures as ordinates, with time as abscissa we have a correct representation of the generation of alternating currents, and the shape of the wave. When the total number of lines cut per revolution by a coil revolving at constant speed remains the same, the average induced electromotive force remains constant, regardless of the distribution of the magnetic flux. The effective value, however, the value read by the meter and the value which corresponds in its heating effect to the direct current value, is not independent of this distribution.

**The Place of Alternating Current Systems.**—The direct current for the railway at 550 volts, and for the lighting and power systems of the densely populated centres of our large cities in the Edison three-wire system 110 to 220 volts, seems to have become standard practice. Nevertheless the low radius of distribution without excessive cost of copper, even in the 550 volt railway system with a grounded return, makes necessary a great multiplicity of moderate sized or small plants, operating at low efficiency. It is here that the alternating current comes to the front. While commutators (q.v.) can be built for collecting direct current at 1,000 volts, alternators (q.v.) can be built for 12,000 volts and step-up transformers (q.v.) of high economy are quite possible at 75,000 to 100,000 volts. Remembering that the copper cost is inversely as the square of the voltage, the great possibilities of the alternating current systems are at once seen.

**Energy from Waterfalls.**—Electrical energy from waterfalls that a few years ago were, at most, points of scenic interest, is now supplied to more than 50 cities in North America. The line from the 15,000 H. P. plant at Colgate, California, to San Francisco, by way of Mission San José, where it is supplied with additional power, has a length of 220 miles, and is the longest transmission of electrical energy in the world. The line between the 13,300 H. P. plant at Electra and San Francisco is 154 miles. In the east, the line between Shawinigan Falls and Montreal covers a distance of 85 miles. The great 105,000 H. P. plant at Niagara regularly supplies Buffalo with 16,000 H. P. of energy for railways and lighting.

**The Alternator.**—Small alternators and those of moderate potential usually collect their current from insulated rings mounted on the shaft and connected to the ends of the armature winding. Through brushes, the current is taken to the external circuit. In some machines a rectifier is added for supplying sufficient unidirectional current to produce the necessary additional field to overcome the drop due to increase of load. All commercial alternators are supplied with an exciter, or direct current dynamo, whose function is to supply current to the field windings. The field spools are usually connected in series. The amount of current thus necessary, on a full non-inductive load varies from  $1\frac{1}{2}$  to 3 per cent of the total output of the alternator. Owing to the difficulty of collecting large currents by means of brushes and of preserving good insulation between the rings and

## ELECTRIC ALTERNATING CURRENTS

shaft, the revolving field type of machine is now used in almost all large installations, the field current from the exciter being supplied through cast-iron rings mounted on the shaft, or in the case of the inductor type, consisting of an annular ring surrounding the inductor or revolving element, which consists of laminated iron poles suitably spaced and keyed to the shaft. The windings being stationary, there are no moving connections, either for the field current or the main current of the machine. In either type the alternating current is taken from the terminals of the windings, usually at the bottom of the frame.

**Polyphase Machines.**—If two armatures, of the same number of turns each, be connected to the shaft at  $90^\circ$  from each other, and revolved in a bi-polar field, and each terminal be joined to a collector ring, we have two separate electromotive forces differing in phase by  $90^\circ$  or a two-phase machine. With  $120^\circ$  phase difference and three sets of armatures we have a three-phase winding. By properly interconnecting the three circuits, we may use but three wires for transmission, or four, in accordance with the system used. The construction of multiphase machines is similar to that of the single-phase type, excepting that in the former we have as many armatures, series connected, as there are phases.

In the two-phase three-wire system, the wire from the common junctions of the phases carries 1.414 times the current of the outer wires. The electromotive force between the outer wires is also  $\sqrt{2}E$ , when  $E$  is the electromotive force per phase, or between either outer wire and the common return. When this system is used it is important that the load be carefully balanced on the phases and that the power factor be kept as high as possible in order to keep the voltage on the phases nearly alike at the receiving end. Single phase motors or lamps may be connected to either or both phases, but it is very important that no load be connected between the outer wires, as the effect is to badly unbalance the voltages on the different phases.

In the three-phase star connected system the line voltage is  $\sqrt{3}=1.732$  times the voltage on the coils of the machine, or the machine voltage, which is the pressure between any one of the three line connections and the common neutral. The line current in this system is the current that flows through any one of the machine windings. In the delta connection, the line voltage is the same as the voltage across any phase of the machine, while the line current, being the resultant of two currents, is  $\sqrt{3}=1.732$  times the current flowing through any phase of the machine.

**Energy Polyphase.**—In a two-phase circuit, whether three or four wire, the energy flowing is the sum of the products of each phase current by the phase pressure. Two wattmeters are used. In the three-phase system when  $E$ =volts between lines;  $I$ =amperes on lines;  $W$ =total watts output of machine,—then, whether the connection be star or delta, the total

output is  $\frac{3E \times I}{\sqrt{3}} = 1.732 EI$ , always supposing the system be balanced. Thus the output of the machine is not changed by changing the connections from star to delta. In the balanced three-phase system, one wattmeter will register

the total output if its constant be multiplied by 1.732. Two wattmeters are usually employed.

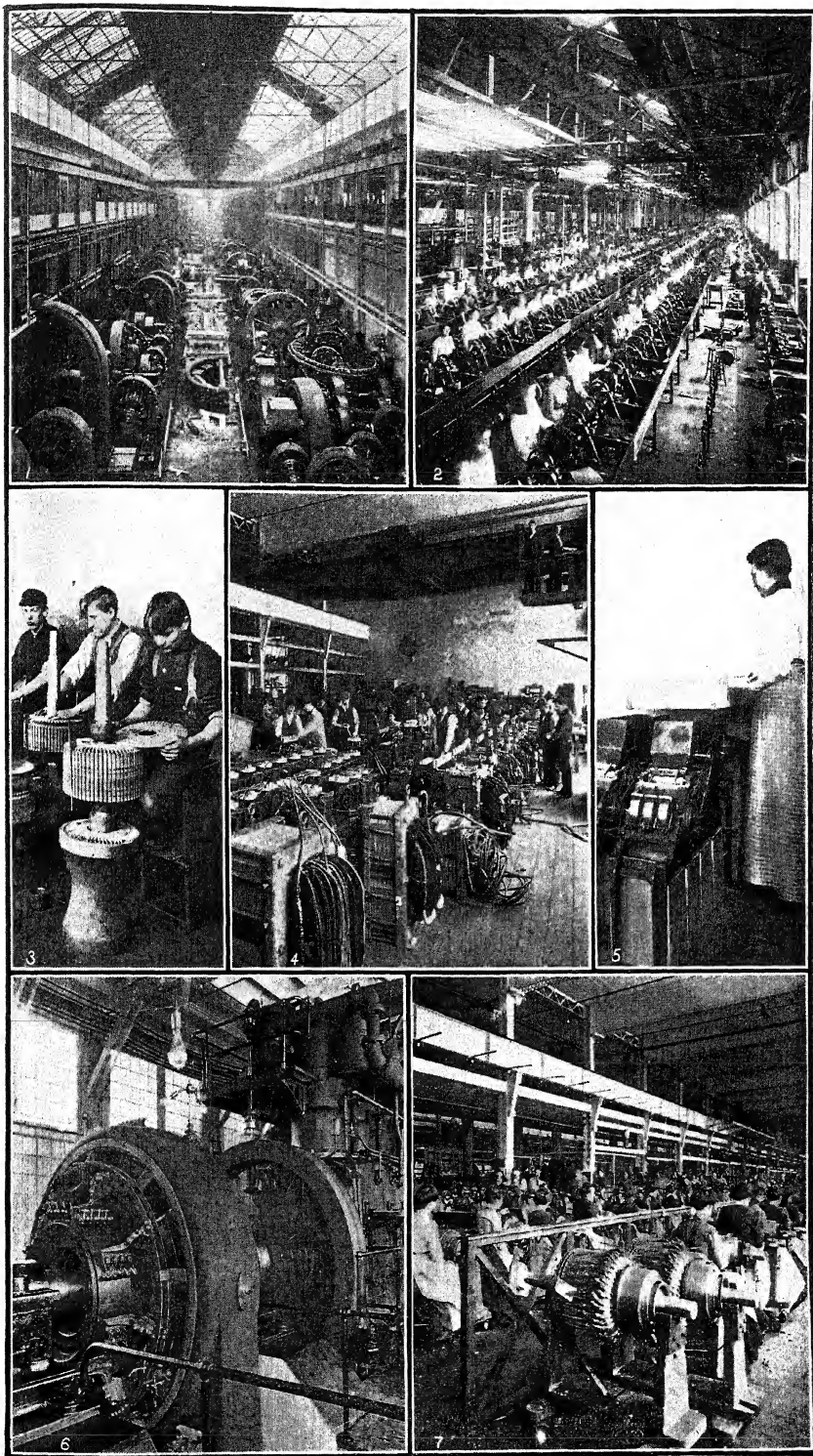
**Regulation of Alternators.**—The regulation of modern alternators varies from 5 to 6 per cent, which means that in case the full, non-inductive load of an alternator be taken off, the speed and excitation being kept constant, the terminal pressure will rise by an amount corresponding to from 5 per cent to 6 per cent of its full load voltage. Close regulation means a much better voltage-regulation on the system and stronger synchronizing power. A certain amount of armature reaction is necessary to avoid large cross currents on changing the field of one or more machines operating in parallel, in the attempt to preserve the same terminal voltage. The efficiency of large alternators is about 96 per cent to 97 per cent.

**Frequency.**—In regard to the frequency best adapted to transmission work, or to local distribution, various factors enter into the problem. At 60~ both arc and incandescent lamps can be operated satisfactorily. The transformers are smaller and cheaper than at 25~ and motors are very satisfactory both as to low first cost, range of speed, and good starting torque (q.v.). Frequencies over 60~ have been abandoned. The line drop, due to reaction increases with the frequency, a change of frequency from 25~ to 125~ would, on the same line, more than double the line drop. While as a rule 60~ apparatus is cheaper than that for 25~ yet the increase in polar speed often becomes difficult without increasing the number of poles to an undesirable extent, which, in 60~ apparatus, may be sufficient to make the parallel operation of low speed direct-connected alternators quite difficult.

**Self-induction.**—When a current is introduced into a circuit a magnetic field is produced, surrounding the conductor, the rise of which causes a counter electromotive force. This electromotive force is called the electromotive force of self-induction. The effect of self-induction upon electric currents is directly comparable to the effect of inertia on a material body. It is that quality that tends to hinder the introduction, variation, or extinction of the current in a circuit. As this effect is greatest at times of most rapid change of magnetism set up by the current, in alternating current circuits, it becomes a maximum when the inducing current is passing through zero, and therefore, the counter electromotive force of self-induction lags  $90^\circ$  behind the current in the circuit. It also follows the sine curve provided the current flowing is sinusoidal.

In a circuit containing several impedances in series, the joint impedance is not the sum of the individual impedances, but is obtained by taking the square root of the total added reactances squared plus the total added resistances, squared, or Impedance =

$$\sqrt{(R_1 + R_2 + R_3)^2 + (2\pi f L_1 + 2\pi f L_2 + 2\pi f L_3)^2}$$
 The joint impedance of several impedances in parallel is found as follows. Construct a parallelogram from the reciprocals of two of the impedances, each expressed in its proper phase relation. The direction of the diagonal will give the phase of the resultant impedance, and its reciprocal amount will give the reciprocal of its length. For more than two, the method of the polygon of forces is applied.



<sup>1</sup> Heavy Construction Work in the Erecting Shops.    <sup>2</sup> A Section of the Winding Department, where Small Coils are Made.    <sup>3</sup> Assembling Armature Cores.    <sup>4</sup> Mounting Large Transformers.    <sup>5</sup> Mica-Splitting Machine.  
<sup>6</sup> 650 Horse Power Gas Engine Generating-Set in the Power Station.    <sup>7</sup> Connecting Street Railway Armatures.

INTERIOR VIEWS IN THE WORKS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.



## ELECTRIC ALTERNATING CURRENTS

The effect of self-induction varies with the frequency of the current supplied, and as the square of the number of turns in a circuit. The self-induction in the armature of an alternator has two effects. The first is to produce a lagging current and thus lower the terminal voltage, and the second is a demagnetizing effect. The current is thrown into such a phase that it produces lines of force directly opposed to the field and thus lowers the voltage by reducing the total flux. The effect of armature reaction depends upon whether the current is leading or lagging in phase. A lagging current lowers the voltage of an alternator and a leading current raises it.

*Capacity.*—All insulated conductors have the quality of being able to hold stored on their surface, a certain quantity of static electricity, and are thus condensers. The charging and discharging of an alternating current circuit causes the current to flow from the generator into the line and then back into the generator again, with the frequency of the alternator, in order to keep up the static potential on the line. As this charging current is greatest when the rate of change of electromotive force is greatest, a sinusoidal wave of capacity electromotive force with  $90^\circ$  difference in phase from the machine electromotive force is produced. This leads the active electromotive force by  $90^\circ$  and is thus  $180^\circ$  or opposite to the electromotive force of self-induction. If we have a circuit in which the electromotive force of self-induction is just equal to the capacity electromotive force, and these two parts of the circuit are in series, the effect of both is neutralized and we have, as in direct currents,  $W = E \times C$ .

*The Transformer.*—The one piece of apparatus that, more than all else has made possible the electrical transmissions of energy to long distances, is the transformer. This is the apparatus that receives in one set of coils the dangerous potential of the line and transforms it into whatever potential is desired for lights or motors, which are supplied from an entirely separate winding. The transformer consists of a magnetic circuit of laminated iron or mild steel interlinked with two electric circuits, one, the primary, receiving electrical energy and the other, the secondary, delivering it to the consumer. The effect of the iron is to make as many as possible of the lines of force set up by the primary current cut the secondary winding and there set up an electromotive force of the same frequency, but different voltage.

Not only does the transformer make possible the transformation of voltages, but it also permits of changing from one system to another. Thus a single-phase primary may supply a three-wire Edison system, of course, with alternating current. A two-phase system can be changed to a three-phase or *vice versa*; a four-wire two-phase may make a three-wire two-phase, and many other useful combinations be effected. The Scott connection for changing two-phase to three-phase, or the opposite, uses but two transformers. One has a ratio of, say, 10 to 1, with a tap at the middle of its secondary coil. The other must then have a ratio of 10 to .867 =

10 to  $\frac{\sqrt{3}}{2}$ . One terminal of the secondary of this transformer is connected to the middle of the other secondary, and the remaining free ends

of both secondaries form the three terminals of a three-phase circuit. The value  $\frac{\sqrt{3}}{2}$  is the altitude of an equilateral triangle of which the base is unity, and thus we may consider the current to be taken from the corners of an equilateral triangle, which represent, in phase and potential difference, a true three-phase system. The current in the transformer of secondary, .867 being the resultant of the other two phases, is greater than under normal two-phase conditions; and, therefore, the windings must have about 15 per cent more copper. If two similar transformers are used the secondary of each has taps giving 50 per cent and 86.7 per cent of full voltage. In many large installations, notably at Niagara Falls, we find two-phase generators feeding three-phase lines through Scott connected step-up transformers. In small systems standard transformers may be used having ratios of 10 to 1 and 9 to 1 respectively, and the results will be quite satisfactory.

*The Induction Motor.*—Acting upon the well-known fact that a copper disk could be made to revolve by rotating a horseshoe magnet so that the lines of force cut the disk, Ferraris, Tesla, Dobrowolsky, and others have developed the present type of induction motor. The credit for the first commercial application of the rotating field caused by currents of displaced phase probably belongs to Tesla. At the present day the value of these discoveries in the transmission and distribution of power can hardly be estimated. The induction motor is somewhat similar to the direct-current shunt motor. Both motors have field and armature windings. In both cases, also, the field is connected directly across the mains. In the shunt motor the armature current is supplied through brushes and a commutator to the windings, while in the induction motor the armature current is an indirect current, the field acting as the primary of a transformer of which the armature is the secondary. In both motors the efficiency is inversely proportional to the armature resistance, as is also the speed regulation of the motors. The less the armature resistance the higher the efficiency and the closer the regulation of speed between no load and full load. In practice, either element may be the one to revolve. The rotation is produced by the reaction of the armature, or indirect current, on the revolving magnetic field, which results in dragging the moving element around in order to keep up with the field flux, as it passes around the face of the primary windings. This field, being the resultant of two or more alternating fields of different phases, rotates with the polar frequency of supplied voltage. The secondary winding is made up of copper bars set in slots in a laminated iron core and running across the armature parallel with the axis of rotation. This separating of the old copper disk into narrow bars constrains the current to flow into the best direction for producing torque and avoids the waste of the unconstrained Foucault currents in the Arago disk, and thus makes the motor much more efficient. Sometimes the secondary windings are joined to heavy short circuiting rings, at both ends resulting in the squirrel-cage type of motor; and in other cases the secondary windings are taken out through collector rings, if the secondary be the rotating element, and

## ELECTRIC ALTERNATING CURRENTS

starting resistances are inserted in series to lessen the reaction due to excessive starting current and thus improve the starting torque. When up to speed these resistances are cut out and the terminals short circuited as in the squirrel-cage type.

*The Asynchronous Generator.*—If the motor be driven by power from an outside source up to true synchronism, no current will flow in the secondary, and the primary current or field current will be wholly made up of the wattless exciting current, just as in a transformer at no load. The slip, or amount by which the motor speed at full load differs from synchronous speed may be as little as 2 to 2½ per cent of the speed of synchronism in large motors, and in small motors may be 5 per cent or more. If the motor above mentioned be forced above synchronism the motor becomes a generator, provided the connection to the mains is left closed, and when a negative slip of the same amount as full load slip as a motor is reached, the generator will be giving out its full output at the same frequency as the exciting circuit. The possibilities of this system are interesting.

*The Synchronous Motor.*—The synchronous motor is merely an alternating current generator of special design. Both motors and alternators have a direct current field and an alternating current armature. The operation of a synchronous motor, when once brought up to speed and thrown into circuit is the same as that of an alternator in parallel with one or more alternators. When the back pressure of the motor is equal and directly opposed to that of the line no current can flow. The friction, however, causes the revolving element to lag slightly behind the line pressure, and a current is driven through the motor by the generator. This current increases directly with the lag behind the central-phase position caused by increased load. A good synchronous motor, while always revolving at the same polar speed as the alternator supplying the line current will carry a load of five or six times full load before it breaks out of step, and becomes practically a short circuit on the system. The current which passes through such a motor on short circuit, while held down by the inductance of the windings, is yet sufficient to rapidly damage the insulation if not cut off. The great advantage of the synchronous over the induction type of motor is that the power factor can be raised or lowered at will. By raising the field strength of a synchronous motor the current taken by the motor may be made leading and hence help keep up the line voltage on a heavy inductive load. This is of the greatest importance in practice. It is good practice to set the field strength for a good power factor at full load. At light loads the motor is assisting the generator to maintain the required pressure. Another advantage of the synchronous motor is that it can easily be built for very high voltage, especially the revolving field type,—a 12,000 volt motor is not at all unusual practice. Thus the use of transformers may be dispensed with.

*The Rotary Converter.*—The rotary converter is a specially designed direct-current generator provided, at proper points in the winding with taps to collector rings, from which, if the machine is run as a motor from the direct current side, an alternating current may be taken. Usually the alternating current is taken from the secondaries of suitable transformers and supplied to the rings, driving the rotary as a syn-

chronous motor, the direct current being taken from the brushes on the commutator. As the reaction of the incoming alternating current about balances that caused by the outgoing direct current, the armature reaction of such a machine is very small and the brushes can be always kept in one fixed position. If the taps from the armature are taken off at points differing 180° from each other, electrically, we have a single-phase rotary. If connections are made 90° apart we have a two-phase rotary, using four collector rings. Taking 120° around the armature for our taps we have a three-phase rotary, using three collector rings. By adding to the number of taps and therefore to the number of rings we may have a six-phase rotary. The output of a rotary is greater than its output as a direct current generator, chiefly, on account of the absence of armature reaction and because at certain positions the current flows straight from collector ring to commutator and thus avoids the loss due to heating. The rotary converter, with its step-down transformer, is the most efficient means we now have of transforming the high tension polyphase currents of our large central stations to direct current for the Edison system, and for railway purposes. This piece of apparatus is wound either shunt or compound, in accordance with the use for which it is intended. As in the case of the synchronous motor, the rotary is a valuable help to the central station by running at a very high power factor. By over-exciting the fields the current taken by the rotary becomes leading and helps to hold up the voltage of the central station in case of a heavy load of induction motors by means of the armature reaction of the generators. Owing to very high commutator speeds at the higher frequencies, rotaries are not much used on frequencies above 60~. At this frequency they operate satisfactorily. At lower frequencies, however, rotaries are at their best, and will stand enormous overloads, sudden changes in load and other disturbances with perfect satisfaction. The voltage of the direct current end of a rotary is that of the peak of the sine wave of the alternating pressure, and thus a voltmeter across the collector rings

would read  $\frac{E}{\sqrt{2}}$  where E is the direct current

electromotive force in single and two-phase rotaries. In the three-phase system the ratio between the alternating current pressure and the direct current at the commutator brushes is  $\frac{\sqrt{3}}{2\sqrt{2}}$ .

$\frac{\sqrt{3}}{2\sqrt{2}} = .613$ . Thus in the Edison system operat-

ing at 250 volts we should have to transform down to  $250 \times .613 = 153$  volts at the secondary of the transformers. While rotaries can be started up without field, from the alternating current side, it is not good practice, excepting in certain special cases. Generally they are started up exactly like a shunt motor, synchronized and then thrown upon the alternating current line. When a rotary is started up from the alternating current side, on closing the field switch it is impossible to tell what the polarity will be. Rotaries operate in parallel with perfect satisfaction, as a rule, on both the alternating current and the direct current sides. The storage battery is always used in a large rotary



## ELECTRICAL UNITS—ELECTRIC BLUE-PRINT MAKING

installation to insure against any possible contingencies. On compound rotaries the equalizer must be used, just as in the case of direct-current compound generators. See **ELECTRIC DIRECT CURRENT**.

A. R. CHEYNEY,  
*Sta. Supt. Phila. Elect. Co.*

**Electrical Units.** See **UNITS**.

**Electric Annealing**, annealing by the heat produced by the passage of the electric current through the body to be annealed. In 1893 an American electrician discovered that a bar of iron immersed in a solution of sulphuric acid and cold water could be easily fused by the application of a strong electric current. The mode of procedure is as follows: The vessel employed is made of glass or porcelain, provided with a sheet-lead electrode connected to the positive pole of a continuous-current generator, and contains a mixture of sulphuric acid and water. A flexible cable from the negative pole is connected to a strong pair of pliers with insulated handles. Taking a piece of metal of any kind and immersing it in the acidulated water, the liquid is seen to boil near the iron rod or plate, which latter is rapidly heated, and brought to a dazzling whiteness in a few seconds, and soon begins to melt. The heating is produced so quickly that neither the liquid nor the body of the metal rod has time to become hot. So rapid an evolution of heat necessarily means a tremendously high temperature. In a very short time a temperature of 7,000° F. has been developed, which is proved by using a carbon rod instead of a metal one, when in a few moments amorphous carbon fragments are seen dropping off. With strong currents the enormously high temperature of 14,000° F., or nearly five times hotter than molten iron, has been produced.

**Electric Annunciator**, a form of annunciator, used in private houses and hotels. See **ELECTRIC SIGNALING**.

**Electric Arc**, a brilliant luminous arc produced when an electric current is passed between two pointed carbon rods placed a short distance apart. The rods are first put in contact so as to allow the current to start. On their being separated slightly the arc is formed, and once formed it serves as a conductor whereby the flow of current is maintained. The temperature of the electric arc is the highest which has been obtained by artificial means. See **ELECTRIC LIGHTING**.

**Electric Aura**, a current or breeze of electrified air employed as a mild stimulant in electrifying delicate parts, as the eye.

**Electric Automatic Fire-alarm.** See **ELECTRIC SIGNALING**.

**Electric Automobiles.** See **AUTOMOBILES**; **TRACTION**, **ELECTRICAL**.

**Electric Balance**, an instrument for measuring the attractive or repulsive forces of electrified bodies. A form of electrometre, consisting of a graduated arc supported by a projecting plate of brass which is attached to the perpendicular column. A wheel, the axis of which is supported on anti-friction rollers, and is concentric with that of the graduated arc, carries an index. Over this wheel, in a groove on its circumference, passes a line, to one end of which is attached a light ball of gilt wood, and to the

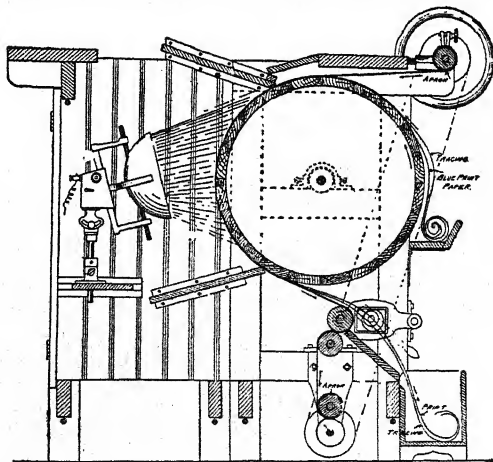
other a float, which consists of a glass tube about one fifth of an inch in diameter, terminating in a small bulb, so weighted that the index may point to the centre of the graduated arc. The difference between the weights of the float when in and out of water is known, and the diameter of the wheel carrying the index is such, that a certain amount of rise or fall of the float causes the index to move over a certain number of graduations on the arc. See **ELECTROMETER**.

**Electric Bath**, in electro-plating, the solution used for depositing metal as contained in a vat or tank. In electro-therapeutics, a bath with suitable arrangements, electrodes, and connections, for treating patients with electricity. See **ELECTROPLATING**; **ELECTRO-THERAPEUTICS**.

**Electric Batteries.** See **BATTERY**; **ELECTRICITY**; **ELECTRIC STORAGE BATTERIES**; **ELECTRIC VOLTAIC BATTERIES**; **PRIMARY BATTERIES**.

**Electric Bell.** (1) Magnetic or dynamic: Two electro-magnets, parallel and in series, having at their extremity a vibrating armature in close proximity pivoted between them; fixed to this armature is a clapper vibrating between two gongs. The current passes through the fields, magnetizing the cores, and in generating an alternating current vibrates the armature and rings the bell. (2) Battery-bell: A single coil or bobbin of wire, wound around an iron core; a vibratory armature, pivoted at one end, and passing at a right angle by the core of the bobbin; at the other end of the armature is a clapper, a gong situated close to the clapper. A delicate spring is attached to the vibratory armature near the clapper, which, while the current is passing, operates against a set-screw placed for the purpose. The current passing through the bobbin to the set-screw magnetizing the core, attracts the armature which in turn is repelled, the spring working against the screw. These alternate attractions and repulsions of the armature vibrate the clapper and ring the bell. See **BATTERY**.

**Electric Blue-Print Making**, a modern process of wholesale photographic printing, by the aid of machinery, the electric light, and the blue-print (q.v.). One of the best machines, shown in the accompanying sectional cut, is



Cross-section of Blue-printing Machine.

continuous in its operation, and is fed by the operator with great lengths of tracings and blue

## ELECTRIC BOAT—ELECTRIC DENSITY

paper in much the same manner as the wash-woman feeds the wet clothes into a wringing machine. The large wooded drum, around which the tracings and printing paper pass, is moved either by a connection with the shafting or by an electric motor mounted on the apparatus, the speed of the drum being regulated by a device shown on the top of the machine. A traveling apron of transparent material takes the place of the glass in the printing frame of the ordinary type, and as it is under tension at all times, it insures an even and close contact at all points. This apron is wound on a small drum at the top, and after passing along the large drum where the contact and exposure take place, it is wound up on the drum below; after the printing operation has been completed it is re-wound by hand back on the upper drum. In the rear of the machine are three arc lamps with reflectors, which concentrate the light on the tracings which, with the exposed prints, drop out into the box in front. The blue paper may be kept in a roll ready for use on the upper front part of the machine, or may be fed in small sheets with the tracings where the work being done is of ordinary size.

The machines are made in two widths, 30 and 42 inches; the apron supplied with them is 70 feet long, and prints of this size can be made as readily as smaller ones where it is desired. The ability to make prints of this size greatly enlarges the sphere of usefulness of the blueprint.

A feature of this machine quite as valuable as its capacity for making large prints is the fact that it can be readily turned into a sun-printing machine. At such times as the sun is available this represents an economy of some considerable moment, for it not only saves the cost of the current, but also makes the prints somewhat quicker, thereby increasing the capacity of the apparatus.

**Electric Boat.** See **ELECTRIC NAVIGATION.**

**Electric Bridge,** a term applied to an arrangement of electrical circuits used for measuring the resistance of an element of the circuit. The most generally known and used are the Wheatstone "bridge" or "balance," and that of the British Association.

**Electric Burglar-alarm.** See **ELECTRIC SIGNALING.**

**Electric Call-box System.** See **ELECTRIC SIGNALING.**

**Electric Candle,** a modification of the arc form of electric light, in which the carbon pencils are parallel and separated by a layer of plaster of Paris. Invented in 1877 by Jablochhoff, a Russian engineer. This invention is noteworthy as having revived an interest in electric illumination. See **ELECTRIC LIGHTING.**

**Electric Chimes,** in frictional electricity, a group of three bells hanging from a brass frame. The middle bell is suspended by a silk thread, but carries a chain connecting it with the earth; the other bells are suspended by chains. Between the bells two small metal balls are hung by silk threads. The apparatus being connected with the conductor, and the machine set in action, the outer bells become charged with electricity; the little balls are first attracted, then repelled toward the middle bell; coming in contact with it, their electricity is discharged.

Again they are attracted by the other bells and again repelled, and so on successively. Thus the balls oscillate backward and forward between the bells, and striking them with some force, a constant ringing is kept up.

**Electric Clock,** a dial with hands and going-train impelled by recurrent impulses from an electro-magnet. The first known clock of this kind was invented by Wheatstone, and exhibited by him in 1840. Appold, Bain, Shepherd, and others have contrived clocks on the same principle.

**Electric Column.** See **DRY PILE.**

**Electric Condenser,** an apparatus for accumulating or condensing electricity. A simple form of it consists of a glass disk with a disk of tinfoil of smaller diameter pasted upon each side. To use it, the glass disk is held by the rim and the tinfoil is presented to the prime conductor, while the other tinfoil is touched with the finger of the other hand. The machine being set in action, the positive electricity bespreads itself over the foil; this acts by induction on the other foil, repelling the positive fluid through the body of the experimenter, and attracting the negative to the side next the glass. Thus in a short time two layers of electricity, positive and negative, are deposited on opposite sides of the glass; they hold each other in bondage, and are unable to unite in consequence of the non-conductibility of the glass. If now the experimenter desires an individual to touch the foils with his two hands, a smart shock is experienced, resulting from the union of the two electricities through his arms.

**Electric Conductors.** See **ELECTRICITY.**

**Electric Cooking Apparatus,** an American invention patented in 1903; an adjustable or flexible electric cooking device. It is based upon the use of heating coils or spirals enclosed within the cooking chamber, associated with portable heater trays in which the coils are grouped between plates. For utilizing these electric trays or heaters the inventor provides an oven or stove consisting of a casing into which the trays are inserted, so as to serve as shelves on which to place the articles to be cooked. The sides of the oven are provided with ledges or cleats for upholding the tray and so that any tray can be placed on any pair of cleats, and thereby set in the oven at any desired height. Removable grids or gratings are provided as shelves between the electric trays or upon ledges not occupied by the latter. The top of the stove is provided with stove holes, as usual, under each of which is provided a special electric tray or heater. For introducing the electric heaters in circuit they are provided with circuit terminals connected to the coils, adapted for connection with exterior conductors with the respective circuit leads; one or both of the connections consisting of a metallic socket in the heater connected with the coils and adapted to receive a metal pin or plug connected by a wire or cable with the stationary circuit lead.

**Electric Currents.** See **ELECTRIC ALTERNATING CURRENT; ELECTRIC DIRECT CURRENT; ELECTRICITY.**

**Electric Density, or Electric Thickness,** the quantity of electricity found on a given surface.

## ELECTRIC DIRECT CURRENT

**Electric Direct Current**, as distinguished from the alternating current, is so-called because of the fact that it travels in one direction along a conductor. If this conductor joins the terminals of a source of energy as a dynamo (q.v.), the current is said to flow from the positive pole of the machine along the conductor to the negative pole.

Probably the first man to detect current electricity was Galvani about the year 1786. To Volta (q.v.), however, is certainly due the credit of first developing a practical electro-chemical cell. In the year 1800 Volta exhibited a cell known as the "Voltaic Pile," consisting of a series of disks, copper and zinc, alternately separated from each other by a cloth saturated with brine; on joining wires to the end disks, quite a perceptible shock may be felt by touching with the tongue or moistened finger, the two terminals simultaneously. This simple cell was the starting point of all the electro-chemical batteries of the present day. With the discovery of Volta of the laws of difference of potential between different metals when placed in contact or joined by a fluid electrolyte, began the development of very many varieties of cells, all on the same principle; yet even now, the two metals he chose, zinc and copper, constitute the elements of the Daniel cell very frequently used for telegraphic purposes. The changes which would readily suggest themselves in Volta's first cell would be, increasing the amount of corroding liquid and placing the elements, zinc and copper, in a vessel which would properly contain the fluid.

The theory as given by Gore of the electro-chemical cell is as follows:

"The essential cause is the stored-up and ceaseless molecular energy of the corroded metal and of the corroding element of liquid with which it unites, while contact is only a static condition; and chemical action is the process or mode by which the molecular motion of these substances is more or less transformed into heat and current."

The electromotive-force of chemical generators is small, rarely exceeding two volts per cell. This necessitated a large number of cells connected in series; that is, the positive terminal of one connected with the negative terminal of the adjoining cell, the electro-motive force thus produced being the product of the electromotive-force of one cell by the number of cells. By connecting the similar terminals, that is to say, the two positive and the two negatives, an increased quantity of current can be obtained at the potential of one cell. The first method is called joining battery cells for intensity and the second for quantity. It is known that the energy generated in a chemical cell is produced by the consumption of zinc. The cost of this energy must necessarily be high as both zinc and the chemicals are expensive, so that the use of current electricity was quite limited until the introduction of the dynamo electric machine which might be called the mechanical method of transforming energy from some source such as a steam engine into current electricity as contrasted with the chemical method.

In the year 1831 Faraday discovered and announced the principle of electro-magnetic induction. This opened up the field of what might be

called the commercial generation of current electricity. The principle discovered by Faraday, which forms the basis of all dynamo electric machines, is that if a wire is moved in a magnetic field, so as to cut the lines of force, a current will be generated in the wire, and it is upon this principle that all dynamo electric machines depend for their action. The converse of this law, he also announced, that when an electric current is applied to the dynamo by some external source such as the battery or another dynamo, the machine will furnish mechanical power so that a dynamo electric machine may be considered either as a generator or as a motor.

All dynamos consist of two essential parts, one, the field magnet, which is usually stationary, and the other, the armature on which the copper conductors are mounted and which revolves on a shaft between the poles of the field magnet. This armature is so arranged as to cut the lines of force flowing between the magnetic poles. The lines of force are imaginary lines flowing from the north pole to the south pole of any magnet. They can easily be traced by placing a piece of paper above the magnet and sprinkling on this paper iron filings. If the paper is covered with mucilage the filings will maintain a permanent position so that they may be studied at the leisure of the student.

The field magnets may be made of steel, magnetized, or preferably they may be electro-magnets made of soft iron over which a coil of wire is wound carrying a current of electricity which induces magnetic lines in the iron. It is to be noted that if the ends of the magnet (q.v.) are bent in the form of a horse-shoe, the lines will be intensified by the reduction of the air space between the poles, and as the amount of current induced in the wire depends on the number of lines of force cut, the greater the strength of the field magnets, the greater will be the current induced.

Considering first the ideal simple dynamo: This would consist of a single loop mounted on centres rotating between the poles of a magnet, each end of the loop being connected to a collector which in direct current machines is called a commutator, and is mounted on the shaft outside of the poles, and insulated therefrom. If the loop is placed in a vertical position and moved through  $180^\circ$ , each side will pass through the whole number of lines of force flowing between the poles which will induce a current in one direction in the loop. If the rotation is maintained in the same direction during the next  $180^\circ$  it will cut the lines of force in the opposite direction, that is, the lines of force will be passing through the loop in the opposite direction to that in the first case. This will induce a current which will be in the opposite direction from the current induced through the first half of the revolution; so that the current will be pulsating, first in one direction and then in the other during each revolution. If the collector or commutator be cut into two halves parallel with the shaft and the ends of the loop be connected one to each half and if a pair of brushes be supplied to collect the current, one above and one below the commutator; when the loop is vertical, the brushes will be changing contact from one end of the loop to the other and as no current is

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then being generated, the change is made without sparking and current flowing in the same direction continuously can be obtained from the brush terminals. During the moment of changing from the one contact to the other, the circuit is momentarily opened or interrupted. This would cause sparking at the brush or collector, were it not that the brushes are placed at a point at which the current is practically zero. This is found in practice to be slightly in advance of the theoretical neutral point on account of lines of force being dragged in the direction of rotation by the conductors.

To advance from the ideal simple dynamo:—the next step is to reduce the air gap between the poles of the field magnet and concentrate the lines of force in the effective space. This is accomplished by placing an iron core on the armature which in the first place reduces the magnetic resistance of the air gap and thus increases the number of lines of force through the armature conductors, and also serves as a support for them. Other machines were built with shuttle wound armatures, the armature consisting of an iron shuttle cut out with grooves longitudinally to take the conductors. These were usually wound with a number of turns of copper wire, the ends being brought out to a two-part collector or commutator. (See **ELECTRIC ALTERNATING CURRENT**.) The next step was to add to the number of coils on the armature so that during each portion of a revolution, some part of the armature conductors would be doing maximum work. Should an additional coil be added to the ideal generator, at right angles to the first coil, the capacity of the machine will be doubled. This complicates, to some extent, the collector rings and may necessitate the opening of the circuit when current is flowing so as to cause sparking and burning of the brush. A machine built on these lines would, therefore, be better adapted for generating small currents as the sparking at the brushes would be otherwise very destructive to the commutator. Machines of this type are known as open coil.

The next important step was made by Gramme and Pacinotti, which was to close the coils with themselves so as to form a continuous circuit in the armature and connect from each coil at its junction with the next one to the collector sections, the number of sections being the same as the number of coils. In the four-coil armature, the current generated can either pass to the collecting brush directly or when it moves out of position so that the contact is broken and made with the next section, the current can flow through the armature coils to the same brush if necessary, and when that coil passes from one polar position to another and is giving current of opposite polarity this current can flow directly to the other brush, and so continuous current is generated. There is also no point at which the circuit is open. There may be a slight sparking as the section moves from the brushes, but violent sparking is reduced as there is always another path for the current to flow to either brush.

The drum armature is distinct from the ring armature in that the wires are wound on the outside of the core and do not pass through it. This type is frequently called the "Siemens'" armature on account of the number of suc-

cessful machines built by Siemens. Of the whole number of lines of force passing between the poles and through the core, there are very few lines passing in the inside, they being diverted by an iron core so that they pass through the wires on the outside of the core; the conductors inside of the core are thus of little use, their only function being to complete the circuit and carry current between the successive turns on the outside of the core; so that by winding the wires on the outside surface only, the amount of idle wire is reduced, the only material that is not active being the cross-connecting pieces at the ends.

The Gramme ring was used very largely on early machines for the reason that it afforded means for easier mechanical construction, and machines of this type were generally successful, on account of their simplicity. Pacinotti designed a core having teeth similar to a gear wheel. In this way the air gap between the armature and pole pieces could be reduced somewhat, resulting in an increased number of lines of force. It also afforded an additional support to the coils and added to the mechanical strength of the machine.

To be considered next are the field magnets: There are a number of constructions which may be employed. (1) The so-called permanent steel magnet which consists of a bar or bars of steel bent to the shape desired, tempered and magnetized. The method of magnetizing these magnets consisted of placing them in contact with other magnets or with an electro-magnet. The present method would be to insert the steel bar into a helix carrying a heavy current and in a short time the bar would be magnetized. The dynamos built with permanent steel magnets of this type are what is known as magneto dynamos. The chief objection to this form of magnets is that a steel magnet cannot be made as powerful as an iron magnet which is energized or as it is commonly called, excited from a source of electricity. In the first generators permanent magnets were used, but a great step in advance in dynamo design was to arrange the magnet poles so as to be self-excited. A portion of the current generated in the armature is sent around the coils wound around the cores of these field magnets so as to excite them. At first, however, magnets were substituted consisting of soft iron upon which was wound a coil of copper wire, the current for energizing these pole pieces being first supplied from a small magneto generator or a voltaic battery. Sometimes the machine will not generate on starting up sufficient current to excite the magnets and it is necessary to excite them from some external source so as to give the initial strength to the magnets and allow them to build up from the current generated in the armature. It is usually found that there is sufficient residual magnetism left in the iron of the field magnets, after the machine has once been in operation, to start the current in the machine and properly build up the fields.

In regard to field windings, two distinct types are used: (1) the series winding, in which all the current generated in the armature passes around the field poles and thence out to the line or circuit; and (2) the shunt winding in which a portion only of the current is used in the field, the connection being made across the main ter-

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minals of the generator. In the first case the wire on the field windings is necessarily large so as to carry all the current for which the machine is designed and in the second case it is a small wire of many turns, the product of amperes and turns being about the same in either case. In another design, both a shunt and a series winding of a few turns is employed, constituting a compound winding.

It will be seen that in the first case, that of the series winding, the field strength will depend upon the resistance of the total circuit including the resistance of the armature, the field winding, and the external circuit. In a machine of this type the voltage or pressure generated will vary in proportion to the demands. This is the standard winding for the series arc machines used for city lighting such as the Brush and Wood types. In the case of the shunt-wound machine the current flowing in the field coil depends upon the pressure between the generator terminals, so that with an increased out-put and consequent loss in the armature the voltage will fall off slightly, thus reducing the field strength. This necessitates some means of varying the field current so as to maintain a uniform pressure at the generator terminals. This is usually accomplished by means of an external resistance in the field circuit composed of German silver or iron wire which can be varied by means of a switch-head so arranged as to cut out certain portion of this resistance step-by-step and so increase the current through the fields, thus preserving a uniform voltage.

In a combination of series and shunt windings commonly called the compound type, as the output of the generator is increased, there is a greater flow of current through the series windings and consequent increase of magnetic strength of fields so that it is possible to compensate for the loss due to the resistance of the armature windings and maintain a uniform pressure at the generator terminals. The output of the dynamo depends upon the strength of the field magnets, the magnetic permeability of the material and the rate at which the lines of force are cut by the armature conductors so that the higher the speed, the greater the output of the dynamo. In the early machines very high speeds were common, armatures of small diameters being employed. These were objectionable for mechanical reasons so that the design was changed in order to increase the number of pole pieces. Instead of the field being composed of two poles, it was arranged so that a greater number of poles could be used, this type of machine being known as the multipolar dynamo. As each conductor would pass between a number of poles during each revolution the speed could be proportionally reduced.

The dynamo, as previously stated, is a machine for converting energy in the form of mechanical power into electrical power, or vice versa, so that a motor is a machine for converting energy in the form of electricity into mechanical power. The early types of motors were based on the principle that a magnet would attract the opposite pole of another magnet, and if one set of magnets is arranged on a wheel, and the other stationary, the movable magnet will be drawn around. To make this effective

it will be necessary to interrupt the forces at what might be called the dead centres so that the wheel would have continuous motion. This is accomplished by either introducing a screen, or, more satisfactorily, by the use of electro-magnets with a movable contact so that the magnets are energized intermittently, allowing the wheel to revolve in accordance with impulses received from the magnetic poles.

When we consider the dynamo as a motor, the current supplied to the terminals will take two paths, one through the armature and the other through the field coils. The field current energizes the pole pieces, and the current traveling in the armature is similar to another magnet inasmuch as a coil carrying the current will be attracted or repulsed by a magnet according to the directions of the current through the coil, so that the wire will be forced around by attraction and repulsion. By considering the effect of the commutator the motion is seen to be continuous. When the armature starts to revolve the conditions then existing will be similar to the armature in action as a dynamo resulting in an electro-motive force being generated in the armature wires, which will be in the opposite direction to the incoming current. This is what is called the counter electro-motive force of the motor, and will tend to reduce the amount of current which will flow through the armature conductors. It is, therefore, evident that when a motor is started there will be a rush of current through the armatures, as the resistance is very small, and as there is no counter electro-motive force while the machine is not in motion to check the flow. For this reason, in the direct current motor it is necessary to introduce an external resistance into the armature circuit to hold back the current which would flow until the machine reaches full speed. The resistance is then gradually reduced until full speed is obtained. The effect of this counter electro-motive force when the resistance is cut out entirely is to materially assist the self-regulating qualities of the machine. Any load applied to the motor would tend to slightly reduce the speed, which effect, by also reducing the counter electro-motive force and allowing more current to flow through the armature, tends to keep the speed from falling much below normal in the shunt motor. Motors can be built either with a plain shunt field winding or with a series and shunt winding, depending on their requirements. The direction of rotation depends on the direction of the current through the armature. To reverse the rotation, therefore, it is only necessary to reverse the current in the armature, leaving field connections as they are. If the current is changed in both field and armature, the result would naturally be that the machine will continue to revolve in the same direction as before.

To reduce the speed of the direct current motor it is only necessary to add resistance to the armature circuit so as to limit the current flowing therein, and by so doing almost any desired speed may be obtained, from 1 per cent up to full rate of speed. There are a number of other methods by which variable speeds can be obtained, one of them being by varying the field strength. Any motor, however, operating at a lower field or armature current than normal conditions would require is naturally operating at reduced power. On account of the valuable



## ELECTRIC DISCHARGE — ELECTRIC FIELD

features in relation to speed control, the reversability, and the automatic speed control inherent in shunt machine, together with a large torque of the series machine, the direct current motor fulfils more nearly than any other the practical requirements in machine-shops, textile mills, and general manufacturing establishments.

For electric railway work all over the world the direct current is employed. (See TRACTION, ELECTRIC.) The compound wound generator and series motor being standard practice. Often this type of generator is over-compounded so as to more than overcome the drop through the armature resistance and allow higher voltage at full load than at no load, so as to overcome, in a way, the drop of potential on the feeders and preserve the uniform voltage over the system. In lighting and power work the shunt and compound dynamos are both used. (See ELECTRIC LIGHTING). And in the business centres of our large cities where the direct current is generally used, the rotary converter fed from a high tension alternating central station is very often employed, together with storage battery. One of the chief reasons why the direct current is used so generally in preference to the alternating, outside of the fact that more satisfactory motor may be obtained therefrom, is the total absence of all inductive effects so troublesome in large secondary alternating systems, where the pressures are low and the currents very large. A much more uniform pressure can be kept on the supply mains of a direct current system than an alternating one, especially if many large motors are connected, and this fact, together with the use of the storage battery, which can only be used on direct current systems (for other information on storage batteries see article on STORAGE BATTERIES), enables the large lighting companies to use a very efficient type of incandescent lamp, which, being generally freely renewed by the company, by its longer life aids materially in keeping up the value of the business.

The shunt and series motor each has its own field of usefulness. When a very powerful starting torque and rapid acceleration are necessary the series motor is used, as in the case of street railway, electric locomotives, electric cranes; and on steamships where the direct current alone is used, as on the Kentucky and Kearsarge, of the United States navy, not only is electricity used for lighting, but also for operating ammunition hoists, hoisting anchors, operating boat cranes, and even the steering gear of the ship itself.

In machine-shops and manufacturing establishments where a more or less constant speed may be required, and in elevator work, the compound and the shunt motor are commonly employed. The shunt motor is very well adapted for operating at any speed desired, and for machine tools it is at present without a peer for an efficient and easily regulated source of power. Unlike the series motor, where the speed varies with the load, the shunt motor is practically a constant speed machine. When thrown on the lines it rapidly comes up to normal speed, and then from no load to full load will not greatly deviate therefrom unless purposely thrown to a slower point of the controller. As a series motor would run away if left in a circuit with a load suddenly removed, the shunt motor, or sometimes the compound, which is used in order to preserve an absolutely uniform speed from no load to full load, and is necessary in a few places

where absolutely constant speed is required, is the standard motor for driving textile machinery in large mills, factories, and other establishments.

Direct current is more suitable for general requirements than alternating current. It is essential to use direct current to charge storage batteries. Storage batteries fulfil an important function in direct current distributing systems, as by this means a reservoir is established which is useful in taking care of sudden demands caused by the consumer, or it may take the place of defective generators or apparatus.

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**Electric Discharge**, the escape of electricity, whether slowly and silently, or more quickly and violently, from any receptacle or generator.

**Electric Door-bells**. See ELECTRIC SIGNALING.

**Electric Drill**, a drill for metals or rock worked by an electromagnetic motor. For metals a rotary motion, for rocks a reciprocating or percussory action, is imparted.

**Electric Eel** (*Electrophorus electricus*), a great eel inhabiting the marshy waters of the llanos in South America. It belongs to the family *Gymnotidae* and order *Plectrospindyl* (qq.v.), and with a few allied species is distinguished from all other eels by the partial coalescence and modification of the anterior vertebrae. It is remarkable chiefly for the great size of its electric organs, which consist of two pairs of longitudinal bodies between the skin and the muscles of the caudal region, divided into about 240 cells and supplied by more than 200 nerves. The eel can discharge sufficient electricity to kill an animal of considerable size, and is said to possess power, when in full vigor, to knock down a man and benumb the limb affected, in the most painful manner, for several hours after communicating the shock. By frequent use of this faculty it becomes impaired, and a considerable interval of rest is required to recruit its electrical properties. According to Humboldt the natives of South America make use of horses in taking the electric eel. The animals are driven in a body into a stream or pond where the fishes abound, and the latter, having exhausted their stores of electricity by repeated attacks upon them, are then easily taken. The horses are sometimes so severely stunned by the shocks that they fall and are drowned. Specimens of the *Electrophorus electricus* are reported to attain the length of 6 or 7 feet, but ordinarily they are about 3½ or 4 feet long. The flesh is eatable and is said to resemble that of the common eel in appearance and flavor. See ELECTRIC FISHES.

**Electric Egg**, an ellipsoidal glass vessel, with metallic caps at each end, which may be filled with a feeble violet light by means of an electric machine acting on it after a vacuum has been made inside the glass.

**Electric Elevators**. See ELEVATORS.

**Electric Escapement**, a device actuated by electric impulse which intermittently arrests the motion of the scape-wheel and restrains the train to a pulsative motion—acting, in fact, in the place of a pendulum.

**Electric Field**, any space wherein electric force exists. See ELECTRICITY.



## ELECTRIC FIRE-ALARM — ELECTRIC FURNACES

**Electric Fire-alarm.** See **ELECTRIC SIGNALING.**

**Electric Fishes,** several quite unrelated fishes which possess the extraordinary property of communicating an electric shock to animals with which they come in contact. The organs which are the source of this power have been much studied by both anatomists and physiologists. They are in all cases — with the possible exception of *Malapterurus* — formed by the modification of muscular tissue, and consist of a mass of numerous closely packed prisms, each divided into a series of compartments filled with a gelatinous substance. One surface of the fibrous disks thus formed receives a rich nerve supply and is electrically negative, the opposite surface being positive. The entire organ may therefore be likened to a group of voltaic piles. Among the *Elasmobranchii* (q.v.), many of the skates possess rudimentary electric organs, which reach a high degree of development in the torpedo (*Torpedo*, q.v.) and an allied genus (*Hypnos*). In these two genera the organs occupy a large area on each side of the head and the prisms are arranged vertically and are supplied by large nerves, four pairs of which arise from a special electrical lobe of the hinder part of the brain, while a fifth is a branch of the trigeminal. In the electrical catfish (*Malapterurus electricus*) of the Nile, and some allied species, the entire body is enveloped by an electric layer beneath the skin and the muscles. In the electric eel (q.v.) and all other electrical fishes the organ is placed by the side of the tail and the prisms are disposed longitudinally. Not alone in structure but in the phenomena of rest and activity these organs bear a striking resemblance to muscles, which also normally exhibit weak electrical currents.

**Electric Fluids.** In order to explain electrical phenomena a theory was propounded by Dufay and Symmer, and now very generally adopted among physicists. The "theory of electric fluids," as it is called, is as follows: That every body contains an indefinite quantity of an imponderable subtle fluid, that this fluid is composed of two fluids which are self-repulsive but mutually attractive. When a body is in its natural state, the two fluids are in combination, and neutralize each other. The act of electrification consists in the forcible separation of the two fluids, whereby one is diffused over the body rubbed and the other over the rubber, one kind of electricity never appearing without an equal quantity of the other. This theory, however, must be regarded as a mere provisional conception, and not a proved scientific truth.

**Electric Furnaces.** Electric furnaces are devices for localizing the heat of an electric circuit and utilizing it. In the usual technical use of the term a comparatively high temperature is developed for the purpose of effecting a chemical reaction or producing a change of state in the substance to be treated, such, for instance, as the reduction of an ore, the formation or disruption of a compound, or the fusion or volatilization of a metal or compound. Electric furnaces comprise means for developing the necessary heat at the point or points desired, and for subjecting the material to be treated, technically known as the "charge," to the influence of this heat. The several types or classes

of electric furnace will be briefly described according to the principles employed. The heat development in any given portion of a circuit is proportionate to the resistance offered to the passage of the current; hence those portions of the circuit external to the furnace proper are always composed of metals which conduct the current well, and generally of copper or aluminum, whereas the resistance of those portions of the circuit in which the heat is to be localized is relatively high. These latter portions of the circuit may consist of gases, in which case an arc is formed and the localization of the heat is extreme; of substances of high melting and boiling points, in a state of fusion, when an electrolytic effect, to be hereinafter more fully referred to, usually supervenes; or of solids, such as platinum and other difficultly fusible metals, carbon, graphite and carbonaceous mixtures, or such bodies as the oxides of the alkaline earths which become conductive when heated. These three classes of furnace, wherein the heat is localized in a gas, a liquid, and a solid, respectively, may be conveniently designated by the terms arc furnace, electrolytic furnace, and incandescent furnace, although as will appear it is not always easy to apply one or another of these names to the actual constructions. Although electrically developed heat is relatively costly, the fact that it can be locally applied, within the interior of the charge if so desired, is an important advantage, and the utilization of the heat is often so complete that its use represents a real economy. The heat lost is that which is carried from the furnace by the escaping products of the reaction, and that which is conveyed by radiation, convection, or conduction, from the walls, the electrodes, and other exposed portions of the structure. Inasmuch as the exposed surfaces of a furnace are roughly proportionate to the square of its dimensions, whereas its capacity varies as the cube, it is evident that other things equal, the larger the furnace the less will be the percentage of total heat which is lost and the greater will be the efficiency. This indicates the employment of large units. It is always possible to reduce the expenditure of electrical energy by making use of heat otherwise generated, such heat being employed for raising the temperature of the charge previous to its introduction into the electrically heated zone, or for heating the exposed surfaces of the furnace structure in order to check radiation therefrom. Furnaces in which chemical reactions are conducted, as, for instance, those in which calcium carbide is produced, often yield gaseous products which are not only themselves very highly heated, but are capable, by combustion, of further heat development. It has frequently been proposed to utilize this heat by conducting such gases through or around the incoming charge or by burning them in flues surrounding the furnace, but the greater complexity of the structure and the difficulty of purifying the large volume of dust-laden gas constitute practical difficulties of a serious nature.

**The Arc Furnace.**—When an electric arc is formed in air between carbon terminals there is observed to be a definite limit to the length of arc which can be maintained with a given current strength; furthermore this limit which at first increases almost in proportion to the current strength, increases very slowly as the

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current density reaches higher values. The maximum length of the arc is therefore limited. The temperature of the carbon terminals may attain  $3,500^{\circ}\text{C}$ ., at about which point, under atmospheric pressures, carbon volatilizes. The temperature of the incandescent gases of the arc is perhaps a thousand degrees higher. It follows that the arc furnace, in its simplest form, is adapted particularly for subjecting small charges to extremely high temperatures, and its value for experimental work is apparent. For use upon a commercial scale it is generally necessary to so distribute the heat from the arc that a comparatively large body of the charge may be acted upon in a given time. This result may be accomplished by establishing a plurality of arcs in adjacent portions of the charge, by exposing the charge to the heat radiated from one or several arcs not in contact with it, by causing the arc to move relatively to the charge, or by moving the charge through or past the arc. The temperature of that portion of a charge which is in immediate contact with an arc may be practically that of the arc itself and is uncontrolled; the operations for which this method of procedure is suitable and economical are relatively few. The high temperatures which the electric furnace is capable of producing have opened a new field to chemistry, but in order to insure the formation, in theoretical quantity and in a state of purity, of many compounds, a careful regulation of the temperature is essential; for the highest attainable temperatures are capable not only of giving rise to new combinations but also of breaking them down, resolving them into simpler bodies or even into their elements. A single instance of the importance of heat regulation may be offered: If a mixture of sand and coke be cautiously heated in an electric resistance furnace a partial reduction of the sand occurs, and a product containing silicon, oxygen and carbon and known as "siloxicon" is formed; at a somewhat higher temperature the reduction is complete and there results an amorphous body having the essential composition of carbid of silicon and technically called "white stuff"; at somewhat higher temperature ranges this amorphous body passes into the crystalline carbid of silicon "carborundum," a compound approximating in hardness the diamond itself; and at still higher temperatures, approximating those of the arc, this carborundum is broken down, its silicon escapes as a vapor, and its carbon remains in the form of graphite. The effect of high temperatures upon reactions is two-fold: in the first place the velocity of the reaction is increased, so that chemical changes which at lower temperatures occur slowly or not at all take place rapidly or even with explosive violence; in the second place new conditions of equilibrium are established, and the chemical elements, entering into that combination which, under the circumstances, is the most stable, sometimes give rise to compounds not before known. To produce a given result, however, it is usually necessary to work within definite temperature limits, and since the heat of the arc cannot well be controlled, it is necessary to govern the temperature of the charge by limiting the duration of its exposure to this heat. As above pointed out, this may be accomplished by moving the arc through or near the charge or by moving the charge through or past the arc, the duration

of contact being so adjusted to the quantity of charge and to its specific heat as to bring it to the desired temperature. As a rule, however, the arc as a source of heat is both wasteful and inefficient.

*The Electrolytic Furnace.*—When a direct current of sufficient volume is caused to pass through a molten salt not only will the salt be maintained in fusion by the heat developed by its own resistance, but it will be "electrolyzed," that is to say, it will be decomposed in such manner that one of its component parts, which may be a metal, will tend to accumulate at one electrode, while another component, which was before in combination with the metal, will appear at the other electrode. That electrode at which the current is assumed to enter the molten bath, and at which the negative or non-metallic portion of the compound appears, is called the "anode," while the other electrode, which receives the positive or metallic element and at which the current is considered to leave the bath, is designated the "cathode." Thus if common salt, sodium chlorid, be fused and traversed by a direct current, the negative element chlorin will appear at the anode and the metal sodium at the cathode. If the substance of either electrode be such that the element liberated in contact with it can combine with or dissolve in it, the corresponding compound or solution will be formed: If, for instance, the fused sodium chlorid be electrolyzed with an anode of carbon and a cathode of molten lead, chlorin will be evolved at the anode and escape from the bath, while sodium, dissolving in the lead, will yield an alloy from which the metal sodium, or its hydroxid caustic soda, may be obtained. In electrolytic furnaces also it is essential to carefully regulate the temperature, not only because an unnecessarily high temperature means a waste of energy, but because of losses arising through volatilization of the bath and the recombination of the separated products of the electrolysis. So important is this last factor that in certain cases, as, for instance, in the separation of metallic sodium from molten caustic soda, it is absolutely essential to the success of the process that the temperature be maintained within limits of a few degrees only.

*The Incandescent Furnace.*—This term is commonly applied to those furnaces wherein the heat is developed by the passage of the current through a body which initially at least is solid. Such body may comprise a rod or core of carbon or carbonaceous mixture; a granular bed or core consisting of fragments of coke, retort carbon or graphite; the charge itself, often admixed with a quantity of carbon sufficient for its reduction; the furnace product when this is conductive and possesses a volatilizing point sufficiently high to permit the necessary temperature to be attained; or a pyroelectrolyte, that is to say, an oxid or mixture of oxids which is normally non-conductive or substantially so, but which while remaining unfused becomes capable at temperatures considerably above the normal of carrying the current. Each of these resistance materials possesses its advantages for particular lines of work, but all have in common the advantage of permitting accurate and ready adjustment of the temperature by varying the amount of current passing. These incandescent furnaces have, therefore, the widest applicability, and in case the resistance

## ELECTRIC FUSE—ELECTRICITY

material used is carbon the maximum temperature attainable is probably not inferior to that of the terminals of the electric arc. The above defined types are not always sharply distinct, but under certain conditions the operation proceeds under two or perhaps all three of the methods. Thus if the resistance consists of fragments of carbon, the current may traverse the interspaces in the form of minute arcs; and if this fragmentary carbon be commingled with a suitable ore or compound there may be present also an electrolytic effect; the primary fusion of an electrolyte is often accomplished by means of a resistance rod connecting the electrodes, or this fusion may be accomplished by the arc. Furthermore a given furnace structure is often capable of either mode of operation according to the character of the charge and the adjustment of the electrodes with reference thereto. The most important as well as the most characteristic applications of the electric furnace have relation to certain elements and compounds which cannot be produced directly, if at all, by other means. See ELECTRO-CHEMISTRY; ELECTRO-CHEMICAL INDUSTRIES.

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**Electric Fuse.** (1) A device used in blasting to explode the charge. The fulminate or the charge itself is lighted by means of an electric spark or a resistance section of fine platinum wire, which is heated to redness by the passage of an electric current induced by a voltaic or magneto-electric battery. (2) A safety device used to protect electric circuits against too great a volume of current. The melting of the fuse will stop the current by breaking the circuit.

**Electric Gas-lighting,** lighting gas by an electric spark. Illuminating gas is principally composed of two elements, carbon and hydrogen, both of which also have a strong affinity for oxygen, but, like phosphorus and sulphur, they will only unite with it when their kindling temperature is reached. In lighting gas with a match all we do is to heat the gas up to this point. But we may light it just as well by any other means that will give the required heat. A piece of red-hot wire will do it. An electric spark does it. There is very little heat in the spark itself, but very little is needed. It is degree of heat required, not quantity. If one tiny particle of hydrogen can be made hot enough to unite with oxygen, it will heat up its neighboring particles and spread the flame in an instant.

**Electric Generation.** See GENERATION.

**Electric Generator.** See DYNAMO; ELECTRIC MACHINE.

**Electric Governor,** a governor in which a part of a fly-wheel, say a segment of the rim, is made to move radially outward when the wheel revolves at a rate above a preappointed speed, and thereby comes in contact with a metallic tongue, completing an electric connection, which is utilized to move a butterfly valve or other device which concerns the transmission of power. Governor-balls flying out to a certain distance may make or break an electric connection to produce the same result, or sound an alarm.

**Electric Hammer.** See HAMMER.

**Electric Harpoon,** an application of the electric current to the explosion of a bursting charge in a harpoon or bomb-lance. A copper wire is carried through the line, and when a circuit is established by the harpooner, a resistance section in the fuse of the bomb-lance ignites the charge.

**Electric Heater,** a form of electric heater based upon the principle of electrical resistance. Some resistant body, such as carbon or platinum, is placed in the circuit, and retains heat upon the passage of the current in proportion to its qualities of resistance.

**Electric Helix,** a coil of copper wire in the form of a screw. The wire is generally coiled around a bar of soft iron, and when an electric current is sent through it, this confers polarity upon the iron, the wire and iron together constituting an electro-magnet. The helix will also manifest magnetic properties without any iron bar.

**Electrician,** ē-lek-trish'an, one who makes a study of electricity or who makes or manufactures electrical appliances.

**Electric Induction.** See ELECTRICITY; INDUCTION.

**Electricity** is a form of energy (q.v.) like mechanical energy or energy of motion, heat, radiating energy as light, chemical energy, etc. Electric energy is the form of energy most recently introduced into everyday life and is, therefore, not yet quite familiar, so that we still ask, "What is electricity?" while ages ago mankind ceased to ask, "What is gravity?" or "What is light?" although the manifestations of electric energy are no more wonderful and inexplicable than those of gravity, that is the cause why a stone falls to the ground and water flows down hill. In nature electric energy manifests itself during atmospheric disturbances as lightning (q.v.), but the energy of lightning is too erratic for use. For the production of electric energy on a larger scale recourse must be had to the stores of energy afforded by nature. In large amounts energy is found in nature, first, as mechanical energy in the waterfalls and to a lesser extent the wind, and second, as chemical energy in coal, wood, oil, natural gas, etc.

**Generation.**—In the transformation of the mechanical energy of waterfalls into electric energy, the water-power is first converted into rotary motion by the turbine or water-wheel, the latter then converted into electric energy by the electric generator or dynamo. Chemical energy can be converted directly into electric energy only to a limited extent, as chemical energy of metals. This is done in the electric battery. (See BATTERY.) But due to the high cost of the chemical energy of metals, the production of electric energy by means of the battery is commercially feasible only where small quantities are required and the cost of the energy therefore secondary to the convenience of generation, as for signaling purposes, bells, annunciators, etc. The chemical energy of coal and other combustibles cannot be directly converted into electric energy, but is converted into heat energy by combustion, the heat energy transferred from the gases of combustion to the water in the steam boiler, converted into mechanical energy in the steam engine and the mechanical converted into electric energy in the

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electric generator. In the gas engine the heat energy of combustion is directly converted into mechanical energy. In any transformation of energy from one form to another a certain loss occurs by conversion into heat. This loss is moderate in the transformation of water-power into mechanical energy, very small in the transformation of mechanical into electric energy, but enormous in the transformation of heat into any other form of energy. Our modern theories consider all forms of energy as different modes of motion; of the masses in mechanical energy or of the molecules and atoms of matter with electric, chemical, etc., energy. Heat is the simplest form of energy, irregular motion of the molecules or motion without definite speed and direction. It is, therefore, intelligible that in any conversion of energy, that is of a regular motion into another regular motion, some of the energy is lost by losing its regularity of motion, that is converted into heat, the more the greater the difference between the two forms of motion, and that when converting irregular into regular motion, that is heat into other forms of energy, this loss is specially great. The cost of electric-power derived from water-power does not differ much from that derived from coal by the steam engine, the cost of coal in the latter case offsetting the interest on the greater investment required in developing the water-power and transmitting the electric-power to the place of consumption. Hence where coal is cheap the steam-power may be more economical where water-power is found which can cheaply be developed, or where coal is expensive water-power is more economical.

*Use.*—Electric energy is hardly ever used as such but only after transformation in other forms of energy, mainly mechanical energy, heat, chemical energy, and light. Since electric energy is generated from other forms of energy, it follows that it is used essentially as intermediary form of energy. For this it is better suited than any other form of energy, due to the high efficiency and simplicity of generation and re-conversion, and especially the almost unlimited flexibility which permits transmission over long distance, distribution with the simplest means, and unlimited subdivision and ease of control.

*Mechanical Power.*—The electric motor is a secondary and not a primary source of power, that is, it does not convert the stores of energy found in nature into mechanical energy as the steam engine, but mechanical power has to be extended somewhere to produce the electric power which is re-converted into mechanical power in the electric motor. The advantage of the electric motor is that the mechanical power can be utilized at a distance from the source of power; the factories and mills may be located far distant from the water power and the railroad train or street car receive the power from the distant station. The power generated at one place can be distributed efficiently to a large number of places, or all motors of the city may receive their power from one central generating station. Instead of an extended and inefficient system of belting, individual motors may drive the machines of the factory or mill. All the cars or trains of a railway system may receive their power from one generating system, perhaps a water-power as Niagara. The electric motor is under more perfect control than

almost any other motor, and when not used consumes no power and requires no special care in starting and operation. Mechanical power in small quantities can be produced almost as efficiently as in large units and a great subdivision of power becomes thereby feasible. In the field of mechanical power generated by electricity also belong telegraphy and telephony, or the transmission of signals and speech over long distances.

*Light.*—For lighting, electric energy is first converted into heat and the light given by the incandescence of solid substances, exclusively carbon, the carbon filament of the incandescent lamp, or the glowing tip or crater of the arc lamp carbons. (See ELECTRIC LIGHTING.) Here again, especially with incandescent lamps, the main advantage lies in the absolute steadiness, control, and flexibility of the light, the simplicity of turning it on or off, and its relatively high efficiency, which gives a light with less heat than the gas flame or kerosene lamp. While due to the use of heat as intermediary form of energy only a very few per cent of the electric energy are converted into light, most being dissipated as heat, with the gas or kerosene flame the percentage of energy converted into light is still much less. Recently considerable work is being done and with great promise, of converting electric energy directly into light by electro-luminescence in luminous arcs, which promises an efficiency of light production very much greater than the incandescent or carbon arc lamp.

*Heat.*—The conversion of electric energy into heat means a degradation of energy from regular to irregular motion and in the heat production by electric energy only a very few per cent of the heat energy expended under the boilers of the steam engine driving the electric generator is recovered, so that electric heating is much more expensive than direct generation of heat by combustion and therefore commercially practicable only.

1. For the production of temperatures beyond those which can be reached by combustion. At very high temperatures chemical affinity and therefore combustion ceases and temperatures beyond this cannot be reached by combustion but are reached by conversion of electric energy into heat in the electric furnace. By this means chemical compounds have been produced for industrial purposes which were either entirely unknown or mere curiosities before, as the carbides, calcium carbide, carborundum, silicon metal, etc.

2. Electric energy is used for heating where the temperature has to be perfectly controlled.

3. Due to its convenience and cleanliness for domestic uses, to a limited extent, electric heating and cooking are coming into use.

*Chemical Energy.*—Electric energy is converted into chemical energy either directly in the electrolytic cell or indirectly with heat as intermediary in the electric furnace as discussed above. Electrolysis (q.v.), that is the chemical action of electric energy, is used exclusively for the production of aluminum metal, is used for copper refining, production of sodium, chlorates, soda, and bleaching powder, and many other compounds.

*Storage.*—Electric energy cannot be stored as such conveniently, but the ease and efficiency of conversion of electric energy into the chem-

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ical energy of metals and metallic oxides, and inversely, permits the storage of electric energy as chemical energy in the storage battery. (See ELECTRIC STORAGE BATTERY.) Charging the storage battery means converting in it electric energy into chemical energy, discharging, the re-conversion of the chemical energy into electric energy.

*Measurements.*—Since all forms of energy are convertible into each other they can be measured by the same measure. Heat being the simplest form of energy, the measure of heat is the universal measure of energy. It is the calorie, or the amount of heat required to raise one litre of water from  $0^{\circ}$  to  $1^{\circ}$  C. Chemical energy is exclusively measured in calories. All other forms of energy usually have some other measure convertible into calories. So, mechanical energy is measured in foot-pounds, or kilogram-meters, and the flow of mechanical energy, or mechanical power, in foot-pounds per second or horsepower,  $1 \text{ horsepower} = 550 \text{ foot-pounds per second} = 75 \text{ kilogram-meters per second} = .176 \text{ calorie seconds}$ . The value of electric energy or electric power is measured either in the mechanical measure, horsepower, or electric measure, watts,  $746 \text{ watts} = 1 \text{ horsepower}$ . Usually the kilowatt or  $1,000 \text{ watts} = 1.35 \text{ horsepower}$ , is used.  $1 \text{ kilowatt} = .238 \text{ calorie second}$ . Most forms of energy are resolved into the product of two components; a quantity and a pressure component, as the power of a waterfall is the product of the quantity of water flowing and its head or fall. So electric power is resolved into a quantity component called "current" and measured in amperes, and a pressure component called "electromotive-force" or "potential difference" or "voltage," and measured in volts, and the electric power then is a product of volts and amperes,  $1 \text{ watt} = 1 \text{ volt} \times 1 \text{ ampere}$ . Just as a small quantity of water under a high head may give the same power as a large quantity under low head, so a small current at high voltage may represent the same electric power as a large current under low voltage. The smaller the quantity and the higher the voltage the less the loss in transmitting the power. Therefore, for long distance transmissions high voltages are used, the higher the greater the distance, while relatively low voltages are employed for general use, due to the difficulty and danger of handling high voltages. The instrument measuring electric power is called the wattmeter, that measuring electric current or flow of quantity is the ammeter, that measuring electric pressure or voltage is the voltmeter.

*Conductors and Insulators.*—Some substances, as metals, carbon, salt solutions, etc., are conductors of electricity, others as air, glass, rubber, paper, oils, etc., are insulators. There is, however, no perfect conductor nor perfect insulator, but even the best conductors: silver, copper, aluminum, offer still some resistance to the flow of electric power and thereby cause a loss of energy which is proportional to the square of the current flowing and appears as heat in the conductor. For transmission of electric power conductors are therefore used to direct the flow of power, copper or aluminum, surrounded by insulators, as rubber, paper. It is not sufficient, however, merely to surround the conductor by insulating material, but the insulating material must have sufficient thick-

ness to withstand the electric pressure or voltage, otherwise it is disrupted, that is, the electric power penetrates it as spark discharge. The ability to withstand electric pressures is called the dielectric or disruptive strength and is of foremost importance in insulating electric circuits of high voltage. Very good insulators are not necessarily of very high dielectric strength, for instance air, which is perhaps the best insulator, has rather low disruptive strength, that is, is easily penetrated by an electric spark, while mica and rubber, although not as good insulators as air, have very much greater dielectric strength.

*Physiological Effects.*—Electric energy is perceived by the senses either indirectly by transformation into other forms of energy, as light and sound in the spark discharge or lightning, or directly if the electric current passes through the body. A large current of very short duration: an electric discharge causes a shock which when very powerful, as in lightning, may be fatal. A current flowing continuously through the body causes a specific sensation which with increasing voltage and therefore increasing current, becomes unbearable, the muscles contract and become uncontrollable, so that in case of accidental contact with electric circuits the victim is unable to let go, and ultimately at high voltages death may result. (See ELECTRICITY, CAUSE OF DEATH BY.) The amount of current flowing through the body depends upon the electric pressure or voltage and the resistance of the body. This resistance is mainly the skin or surface resistance, therefore depends upon the nature of the contact between body and electric circuit. When loosely touched with dry hands a 100 volt circuit may hardly give any sensation, while grasped with wet hands a 50 volt circuit may be unbearable. Only at very high voltages the nature of the contact becomes of less importance and the electric current penetrates as arc. Electric pressures of 500 to 600 volts are considered as still safe, since only in cases of exceptionally good contact with such voltages serious results may occur. Much higher voltages are usually fatal, but instances are on record of contact with 10,000 to 12,000 volts without fatal results, in cases where the duration of the contact has been very brief.

The causes of death by electricity are:

1. The direct effect of large power exerted upon the body, causing destruction by heat, etc., as in electrocution where several horsepowers are used.
2. Mechanical destruction of vital organs by very heavy discharges, as lightning.
3. Paralysis of the nervous system, stoppage of the heart and respiratory organs. In these cases resuscitation by artificial respiration, etc., when immediately resorted to, is very promising.

Therapeutically electricity is used as stimulant by its action on the nervous system and for carrying substances through the skin into the body electro-chemically. It is very useful in the hands of expert physicians but like any powerful agent in the hands of a layman, is harmful and dangerous. The electric healing devices advertised broadcast, as electric belts, etc., are mere swindles and without any value. See ELECTROTHERAPEUTICS.



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*Prospect.*—Only the very beginning has been made in the use of electricity as secondary form of power for transmitting energy from its natural source, waterfall or coal mine, to the place of consumption, factory, city, railway. Here very great strides are still to be looked forward to, resulting in a much more efficient use of the stores of energy afforded by nature. In the production of light from electric energy at present the efficiency is low, due to the use of heat as intermediary form of energy. A direct conversion of electric energy into heat giving an efficiency of 50 per cent or more would make electric lighting many times cheaper than any other form of illumination and so displace all other illuminants. In this direction fair promise of a gradual advance exists. The direct conversion of the stored energy of coal into electric energy and thereby the elimination of the enormous loss of energy between the chemical energy of the coal and the electric energy, is still entirely hopeless and no clue to its solution visible. In electro-chemistry (q.v.), that is the transformation of electric into chemical energy, lies an enormous field which has hardly been touched, although it has already produced powerful industries, as the aluminum and carbide production and therefore holds out the hope of most wonderful advances in the future. See ELECTRO-CHEMICAL INDUSTRIES; METALLURGY; and various other articles in this volume on electrical subjects.

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**Electricity, Animal.** See ANIMALS; ANIMALS, MAGNETISM IN.

**Electricity, Atmospheric.** To determine the analogy between the electric spark as obtained from an electrical machine and the lightning flash, Franklin, in 1752, made use of a kite provided with a pointed rod. This being flown toward the electric cloud, the electricity was drawn through the pointed conductor, led down the hempen string (which was connected by a silk cord wound round a bobbin) to a key, and then passed to a conductor in communication with the ground. Very brilliant sparks could thus be obtained with perfect safety to the experimenter. This experiment of Franklin's was conclusive as to the analogy between atmospheric electricity and the ordinary electric spark. By experiment it has been found that the atmosphere is always more or less charged with electricity. When the sky is clear, it is charged with positive electricity; when lowering or cloudy, sometimes with positive, at other times with negative electricity. From what source or sources does that electricity come? Some physicists have ascribed it to the friction of the air upon the ground, others to the vegetation of plants, and others again to evaporation. It is probable, from modern research, that all the three causes are in operation; the two chief sources, however, are believed to be the vegetation of plants and evaporation. The clouds, then, which float in the atmosphere are more or less charged with electricity; some are charged positively and others negatively. See LIGHTNING.

**Electricity, Cause of Death by.** The increasing use of electrical industrial currents has brought about conditions of danger to life by which large numbers of people are killed yearly. Statistics regarding deaths caused by

this modern Juggernaut are difficult to obtain, but the evidence seems to show that the number of deaths by electricity would probably reach up into the thousands. As is well known, one of the most important safeguards of the human body against the passage of electrical currents through it is its high degree of resistance. This degree of resistance, however, is subject to a considerable amount of variation. If the skin is dry the resistance is from 5 to 20 times as great as when the skin is wet. From what is known of the amount of electrical current necessary to cause death in man, it is probable that 1,600 volts of electromotive force, of a continuous current, is sufficient to bring about this end, and that an alternating current of half this voltage would probably be fatal. In fact, the general deduction has been drawn from the experiments conducted in electrocution work at the Sing Sing prison, that no human body can withstand an alternating current of 1,500 volts, and 300 has produced death, while for the continuous current it may be necessary that over 3,000 volts may be required to bring about fatal results. Some of the minor injuries due to lightning and electricity are severe burns, paralysis of some of the muscles, deafness, loss of smell and taste, hysterical phenomena, traumatic neuroses. Occasionally blindness has resulted, also insanities of the maniacal type have been known to occur following lightning stroke. As to the cause of death by lightning and electricity, modern research has shown that there are marked changes in the blood vessels, of a hemorrhagic type, and minute alterations in the nerve cells, but these seem to be secondary to the physiological action that the electrical current has upon the fibres of the heart muscle. The electrical shock brings about a condition of delirium or fibrillary contraction of the heart muscle, causing a stoppage of that organ. This theory of the cause of death at present has the largest number of adherents.

As to what can be done for the treatment of electrical shocks, medical science is still somewhat in doubt. For all practical purposes, death, when it takes place, is instantaneous. The evidence derived from non-fatal cases is of great interest. In these, personal experience has shown that a number of individuals who have been rendered unconscious have recognized in the brief moments of consciousness the experience of a strange sensation. Some have even recognized what the character of the sensation was and the general experience has been that this sensation is not painful but is an exaggeration only of the uncomfortable feeling induced by the faradic battery. It seems more than probable that no painful sensations are felt by those who have died. Recoveries from the shock of electricity or lightning which have been severe enough to bring about unconsciousness are very common. As to the border lines which separate the recoverable from the fatal cases it seems difficult to determine. Promptness in the treatment is imperative. External heat to the body, artificial respiration and cardiac stimulants should be used simultaneously. It is of importance to remember that the body of the patient must not be touched by the rescuer with naked hands, but should be dragged away by his clothing, or removed from contact with the earth by slipping a board under him thus to break the connection with the live



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wires. Live wires may also be raised by a stick and thus take the body out of the circuit. Artificial respiration (q.v.) by the Sylvester method or by means of the Gibbon's pump should be performed and the body should be surrounded by hot bottles or bricks, and rubbed, and whiskey and other cardiac stimulants utilized. Injections of large quantities of hot salt solution into the rectum may be of service and occasionally it may be necessary to infuse normal salt solution directly into the veins. Efforts at artificial respiration should not be discontinued under from three to six hours.

Consult: Jelliffe, 'Peterson and Haynes Textbook of Legal Medicine and Toxicology.'

**Electricity, Contact Theory of,** a theory which assumes that the electromotive force of a voltaic cell, and perhaps the electricity produced by friction, is due to the difference of potential assumed by two dissimilar substances when placed in contact.

**Electricity, Diffusion of.** Electricity diffuses itself on the surface of a conductor. This we may expect from the self-repelling character of the same fluid. An insulated spherical conductor has two hemispherical cups carefully fitted to it, each attached to an insulating handle. The conductor and its covering are charged with electricity, the cups are then removed, and the conductor is brought near an electroscope. No divergence of the leaves occurs, indicating that none of the electricity has passed into the conductor. If the conductor have a spherical shape, the electricity distributes itself equally over the surface; in other words, the density is the same in every part of the surface. We may conceive the electric fluid to surround the conductor as an ocean of equal depth. If the conductor be a brass disk, the electricity is found in greater quantity at the edges or rim. If it be a brass cylinder with rounded ends, the density is greatest at the ends. If the conductor have the shape of a cone, the density is greatest at the apex, and the sharper the apex the greater the density. Hence the remarkable effect of a pointed body in either drawing, or parting with, electricity.

**Electricity, Dissipation of.** The gradual loss of electricity from a charged body surrounded by non-conductors, which takes place by means of them, is called dissipation of the electric charge. A charged conductor, for instance, supported on a glass pillar, slowly loses its electricity. This is due partly to the creeping of the electricity along the surface of the glass, which even if it be free from dust and dirt, is never absolutely free from an invisible film of moisture; and partly to the air that surrounds the conductor, the particles of air becoming charged and flying off, carrying electricity with them. In performing delicate experiments such as those of Coulomb for determining the laws of the distribution of electricity on conductors, this gradual loss must not be neglected; and accordingly Coulomb made a careful investigation into the laws of dissipation, by which he was able to allow for it in cases where he could not arrange his experiments so as to be undisturbed by it. Coulomb was led by his experiments to abandon the use of glass as a support for his conductors whenever it was possible, employing instead thin

stems of shellac, and sometimes suspending small electrified bodies by well-dried silk fibres. He found that the amount of loss in a given time by means of the particles of air diminishes as the charge possessed by the conductor gets weaker and weaker, the losses in successive equal intervals of time being in geometrical progression.

**Electricity, Experimental Researches in,** by Michael Faraday (1839-55). A monumental work in the literature of science; not merely recording the results of experiment in what Tyndall called "a career of discovery unparalleled in the history of pure experimental science," but enriching the record with thoughts, and clothing it in many passages in a style worthy of exceptional recognition. In devising and executing experiments for passing beyond the limits of existing knowledge, in a field the most difficult ever attempted by research, Faraday showed a genius, and achieved a success, marking him as a thinker not less than an observer of the first order. In strength and sureness of imagination, penetrating the secrets of force in nature, and putting the finger of exact demonstration upon them, he was a Shakespeare of research, the story of whose work has a permanent interest. He made electricity, in one of its manifestations, explain magnetism. He showed to demonstration that chemical action is purely electrical, and that to electricity the atoms of matter owe those properties which constitute them elements in nature. In language of lofty prophetic conception he more than suggested that the physical secret of living things, the animal and the plant, is electrical. He particularly dwelt on the amount of electricity forming the charge carried by the oxygen of the air, which is the active agent in combustion and the supporter of life in both animals and plants, and only stopped short of definitely pronouncing vitality electrical. He urged very strongly as a belief, to which no test of experiment could be applied, that gravitation is by electrical agency, and that in fact the last word of discovery and demonstration in physics will show that electricity is the universal agency in nature. And among his far-reaching applications of thought guided by new knowledge, was his rejection of the idea of "action at a distance," in the manner of "attraction." If a body is moved, it is not by a mysterious pull, but by a push. The moving force carries it. These ideas outran the power of science to immediately understand and accept. But Maxwell, Hertz, and Helmholtz have led the way after Faraday, to the extent that his electrical explanation of light is now fully accepted. Fifteen years after his death, the greatest of his successors in physics, Helmholtz of Berlin, said in a Faraday lecture in London, that the later advances in electrical science had more than confirmed Faraday's conclusions, and that English science had made a mistake in not accepting them as its point of departure for new research.

**Electricity, Frictional.** It was an observation made by the Greek philosopher Thales, 600 years before the Christian era, that, when amber was rubbed, it acquired the property of attracting light bodies. The cause of this attractive power was assigned to a principle to which the name of "electricity" was given—

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derived from the Greek word for amber. When a piece of wax is rubbed on the coat-sleeve, an attractive power is awakened in it; it is capable of attracting small pieces of light paper or particles of sawdust—a fact well known to every young person. Taking a warm glass tube closed at one end, and rubbing it with silk, the same thing is manifested. It is observed also that after contact with the wax or tube, the light bodies fall away, being seemingly repelled. If a stick of sealing-wax be rubbed with flannel and then balanced on a paper loop suspended by a silk thread and the knuckle be presented to it, the wax will in like manner follow the hand. We have, therefore, the fact that an electrified body attracts or is attracted by an unelectrified body. Another experiment of a simple character may be mentioned. Take a piece of warm brown paper or sheet of foolscap, place it upon a warm board and rub it well over with a piece of india-rubber, it clings to the board; or remove it from the board and apply it to the wall of the room, it adheres to the wall and remains in its position till its electricity is dissipated. See **ELECTRICITY**.

**Electricity in Medicine.** See **ELECTROTHERAPEUTICS**.

**Electricity, Progress of the 19th Century (1800-1900).** Before the year 1800, the world's knowledge of electricity was confined to observations on the attraction of electrified pith balls, and to a few facts in regard to electric sparks. Had it not been for lightning, no one could have felt respect for the feeble manifestations of an agency which was destined in less than 100 years to change the channels of trade, to revolutionize methods of communication, and to light the great cities of the world. Lightning was a portent of all this; but no one yet saw the beneficence in the energy that was so destructive and so terrifying. There was another feeble force, too, of which the world in 1800 knew something—the force of magnetic attraction. This was useful in the magnetic compass; but it was judged to be insignificant in other respects and totally unrelated to the force of electrical attraction, which was manifested in the case of the pith balls, or to the forces of lightning. No one in the wildest flight of imagination saw it exalted to a Titanic force, capable, by means of its relationship to electrical attraction, of moving all the machinery of a great city.

The marvelous development of electricity which we have all seen seems to carry with it the presumption that we have a clearer knowledge of what electricity is than Benjamin Franklin had; but this presumption is not entirely warranted. We certainly know its relations to other forms of motion, such as light and heat, better than he did. We believe that it is a wave motion; but still we cannot fully explain the fundamental experiment of the attraction of two electrified pith balls. To the philosopher, this confession of ignorance of an agency which he can use intelligently, which is highly serviceable, but the origin of which is completely veiled from us, is most suggestive. The question immediately arises, "To what do we owe our command of this mysterious servant?" The answer to the question is this: "We owe our advance in knowledge to the careful verification of phenomena, to the improvements in machinery pro-

duced by almost microscopic measurements, and to accurate calculation."

The steps which led to our present knowledge of the manifestations of electricity can be quickly told. The first was taken by Galvani, who, just before the last century dawned, demonstrated that electricity could be produced by the contact of metals with fluids. His experiments suggested to Volta in 1800 the electric battery. Here was a means by which an electric current could be produced; and Oersted with this current showed a connection between electricity and magnetism. The current in passing through a wire near a compass needle could change the reading of the needle, and the changes depended upon the direction in which the current flowed. There seemed to be a suspension and a hush between each of the turning points in the history of the advance of electricity, which are typified by the stillness before a thunderstorm. Oersted's discovery was made about 20 years after Volta constructed his battery. It was more than 10 years after Oersted that Joseph Henry and Michael Faraday discovered another relationship between electricity and magnetism which involved the possibility of producing currents of electricity by the motion of a magnet. This discovery was the converse of Oersted's; the series of phenomena which it revealed embraced the subject of electro-magnetism, and have led directly to the invention of the dynamo and electric motor. The world, however, did not realize in 1831 the importance of the steps taken by Henry and Faraday. Another 10 years elapsed before the electric telegraph became a success. Then in 1861—30 years from the date of the discovery of electro-magnetism—Paccinotti invented the armature which Gramme improved, and we had the dynamo and the electric motor. Again, in a little more than 10 years, the telephone came, and the mechanical engineers and the mechanic, thoroughly aroused to the possibilities in the practical employment of electricity, took hold with astonishing energy.

When Tyndall came to the United States in 1870 to deliver lectures on light and electricity, he brought with him 100 Grove cells to produce an electric light for the purposes of demonstration. His assistant was obliged to spend two hours before each lecture in arranging these cells, filling them with acids and scraping the connections, retiring from each encounter almost asphyxiated by the irritating and poisonous fumes of nitrous oxide gas. At the present time no lecturer on science in the halls where Tyndall spoke need spend a moment in providing a source of electricity. It is on tap, so to speak, and can be obtained by touching a button. Tyndall in his highest flight of scientific imagination did not picture a development of electricity which would light the halls in which he spoke, which would convey him to and fro with great speed through the streets which he used in going to them, and would enable him to whisper from Boston across the great prairies of the West to St. Louis.

The title of his lectures in Boston was suggestive—"Light and Electricity." Yet his imagination, greater than that of most of his contemporaries in science, failed more completely in the subject of light than in the field of the great practical expansion of electricity. He had no inkling of the coming theory that

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light is but one of the manifestations of electricity, and in 10 years from the date of his lectures would be so regarded by the leaders of scientific thought. When we reflect upon how much this man saw and how much was withheld from him, a feeling of self-abasement comes over us who are students of electricity. Who can foretell what the next 100 years will unveil?

In reflecting on the rapid advances in the employment of electricity, we are apt to overlook the aid which has been given by the improvements in the mechanic arts. It can be maintained with a great show of reason that the modern lathe, the milling machine, together with the principle of interchangeable parts in machines, have made the dynamo and the electric motor. It is said that Joseph Henry spent months in wrapping wire with cast-off gowns to insulate it for his experimental electro-magnets. Much more powerful magnets can be wound to-day in half an hour. The mechanical means of trying experiments in the practical employment of electricity have multiplied to such an extent that every mechanic can enter a field which once was occupied by only one man in America, Joseph Henry; and can enter it with the most refined appliances in respect to tools and materials. Many of the men who have aided the practical development of electricity have known little of the subject of electricity. Some who have achieved distinction as electricians were ignorant of even elementary laws; but they saw how machines could be operated by what to them was a fluid analogous in its manifestations of flow and pressure to water. Just as men were ingenious in transmitting power by pulleys, belts, and chains, they now became apt in devising circuits, switches, armatures, keys, and the multitude of devices of which one gets a realizing sense in reading the advertisements in the thousand and one papers and periodicals devoted to practical electricity. In a similar manner mariners had become skilful in using the winds, the scientific laws of which they had not studied. The men who have made a lifelong study of electricity are amazed in reading the reports of meetings of electrical engineers to see the photographs of hundreds of men prominent as authorities at such gatherings—men who have suddenly sprung into notice in a field where only college professors once worked. A young man seeking to become an electrical engineer is told to-day, with reason, that he should first become a mechanical engineer. This development of practical electricity through the advancing improvements in machinery will continue, undoubtedly, to be a great characteristic of American industry. The first thought, apparently, of an American mechanic when he looks at a piece of foreign-made electrical apparatus is: "How can I improve it?" He speedily tears it to pieces, puts in screws that are interchangeable, takes out clumsy devices, reduces the weight, removes useless lacquer, and makes a new thing of it—if he does not throw the whole affair on a rubbish heap and proceed to build a machine on an idea which he has grasped.

To the American mechanic, who, having lost his corkscrew, inserts an ordinary screw through a piece of wood in the cork and pulls it, is due much of our national progress in practical electricity. I had occasion lately to buy a modern lathe for the Jefferson Physical Laboratory, and

was surprised to find that I should be obliged to wait several months for its delivery. I was informed that 80 per cent of the products of the mills went to France, and Germany, and that foreign labor working 10 hours a day could not compete with American labor working 8 hours on these improved lathes. There is no need of a duty on foreign machinery, for we can trust to the ingenuity of American mechanics to hold the markets.

The efforts of inventors have been turned to electrical devices to such a degree that one has to wait months for a hearing at the Patent Office, and the examiners are so bewildered, apparently, by the claims that they grant patents in the expectation that litigation will settle points which require special study and training to consider properly. In addition to the honest inventor of electrical apparatus, we have another class, who seek to cover the ground of possible advance and to reap the fruits of subsequent study by patient investigators. They stake out claims and sit down, waiting for the worker. This class is not confined to the rank of inventors. There are sensation mongers who make predictions of what will be accomplished some day in electricity, in the hope that when arduous investigators have reached with almost superhuman patience the heights imagined, the suggesters will receive the rewards and the distinction. This is a phase of the use of the scientific imagination which was characteristic of the close of the 19th century. The workers of the next 100 years will find it hard to achieve all these outlined advances. But if the advances are not in the direction anticipated, there are other paths which the well-trained man will open, and which will lead to yet undiscovered domains richer than any hitherto attained.

We obtain a realizing sense of the importance of the advance in electricity when we reflect what changes it has wrought in the United States. The invention of the telegraph has falsified the predictions and estimates of many political economists. Sidney Smith, writing to Earl Grey after the acquisition of California, said that this marked the end of the great American republic, for a people spread over such a vast area, having such diversified interests, and separated by such natural barriers, could not hold together. He did not foresee how strongly a light iron wire could bind San Francisco to New York. The introduction of the ocean cable destroyed the class of East India merchants who went down to the sea in ships. Salem Harbor, in which great sailing vessels rode at anchor or drew up to busy wharves, is now deserted.

No longer can a merchant take extensive ventures in ships' cargoes, for the state of the market is throbbled every instant round the world. Thus a revolution has been caused in commerce by electricity. It is still progressing. When the invention of the telephone was made, it was a common remark that it could not supersede the telegraph, for the latter gave a merchant some evidence of a business transaction, while the telephone left no sign. Notwithstanding this lack of evidence, many kinds of business are now transacted over the telephone. Cotton, for instance, is bought and sold in immense quantities, without any written record of the transactions; for business honor is found to be essential, and without confidence in buyer and

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seller no transactions are possible. Thus electricity may be said to work for morality.

While there has been a remarkable extension in the communication of intelligence over great distances, there has been a no less remarkable one in the application of electricity to the conveyance of people and goods. Electric railroads are intersecting the United States in almost as many directions as the telegraph and telephone wires. One can travel from Boston to New York by means of such roads, and they bring a desirable element of excitement and the possibility of change of scene to the farmers' wives, once isolated on the dreary farms of New England. Here again electricity becomes an important agent in the spiritual as well as the material life of the nation. Electric motors have not yet superseded steam motors on any of the great lines, and there does not seem to be any immediate prospect of the change; for electric power cannot at present be transmitted economically 100 miles, and the electric motor suitable for the long-distance transmission of electrical power has not been sufficiently perfected. The accomplishment of the substitution of the electric motor for the present locomotive is something left over for the present century. When this substitution is made we shall not be troubled with cinders, and forest fires will be less frequent.

The chief source of electricity is coal, and the century just closed gives no hint of a possible rival to coal unless we except water power. There promises to be a great development in the use of waterfalls in places remote from tide-water, wherever the transportation of coal adds greatly to its cost. Thus, in Switzerland, water power from the numerous mountain sources supplies both light and electrical power for varied industries. The great plant at Niagara Falls for the transmission of power is watched with interest, for if electrical power can be economically transmitted from the falls to New York, the calculations in regard to the diminishing coal supply of the world would lose their ominous character—unless the geologist can show that the world is gradually drying up. The transmission of electrical power has led to a centralization of steam power in great cities. The small steam engines which were scattered about in numerous workshops have greatly diminished in number, and their place has been taken by electric motors supplied with current from a central station. In the same way the gas engines, which at one time seemed to be rising in importance, have largely given way to the electric motor. Thus the plans to pipe gas from central gas manufacturing to all parts of a city for power is checked by the extension of a more subtle medium, far more flexible in its applications. No one will use a gas engine if he can obtain an electric motor; for the care and repairs on a gas engine are far more burdensome than in the case of its rival. Moreover, electrical power can be obtained or shut off by merely moving a switch or touching a button. The centralization of power in the physical world seems to be a counterpart of that taking place in the commercial world.

On the great battleships, electric motors are supplanting steam engines and hydraulic engines for moving the turrets, handling the anchors and

the heavy guns. This change in the method of distributing power is one of the most remarkable in the development of industry in this century. Steam is still the great moving agency in the world of industry, and electricity is produced by it. Electricity may also be called its servant, for from a central station it generates and transmits what is like a vital fluid to every part of a great city. Steam is still the master of electricity, and there is no prospect of the economical production of electricity by any other agency. This is still the age of steam and not of electricity. The telegraph, the telephone, the electric light, and the electric motor constitute the great achievements in the practical employment of electricity. Great chemical industries are also being established, in which processes are carried on by electricity—notably the manufacture of aluminum, of calcium carbide, of the alkalis, and of carborundum.

In this brief account of the rapid progress in the practical employment of electricity, I have dwelt largely on the aid that the advances in the mechanic arts have given to the development of this employment. The work, however, of the scholars and theorists must not be overlooked. In 1800 there were the one-fluid and the two-fluid theories of electricity—neither of which is now believed by scientific men, though these theories prevailed till nearly the middle of the century. In 1843 Joule established the doctrine of the conservation of energy, by an exact measurement of the equivalent of heat, and this measurement led to the calculation by scientific men of the electrical units, which have made possible the advances by practical men. Without this system of units, founded strictly on the doctrine of the conservation of energy, and the quantitative transformation of steam power into electrical power, practical men would have floundered and business men would have lost heavily in electrical ventures, the expense of which could not have been calculated. After the establishment of the doctrine of the conservation of energy came Maxwell's great hypothesis of the electro-magnetic theory of light. This theory supposes that all forms of energy—light, heat, and electricity—come to us from the sun in the form of electrical and magnetic waves. On this hypothesis, electricity and magnetism are indissolubly connected. One can be transformed into the other—light and heat are electrical. The only difference between electricity and light is in the length of waves in the ether. The century has closed with this grand generalization, the truth of which the entire scientific world is engaged in testing. There is every prospect that it will form the most fruitful hypothesis in the century before us. The experiments of Hertz, who was the first actually to measure waves of electricity, have greatly strengthened the electro-magnetic theory of light. He showed that most of the phenomena of light waves could be repeated with electric waves. They can be reflected, refracted, and polarized. What explanation, however, can we give, on this hypothesis, of the simple experiment of the attraction or repulsion of two electrified pith balls—the apparently insignificant manifestation of electric force with which the century started? How can electro-magnetic waves explain this? It is, indeed, difficult to do this; and to give a reasonable supposition we have to theorize in regard to the

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molecular structure of matter, and the tension under which it exists when it is polarized—that is, when a positive and negative state, typified by a positively or negatively charged pith ball, exist in the neighborhood of other objects. Our new knowledge of the relations of electricity to other forms of energy is probably destined to come from a careful study of the fundamental experiments of the attraction of electrified bodies. We have already entered on this study with renewed vigor, stimulated by the discovery of the marvelous effect of the X-rays in penetrating matter and in making gases better conductors of electricity. Thus we start on the new century with investigation of the same phenomena that Benjamin Franklin considered, but with a far wider comprehension of extended relations, with immensely greater experimental resources, and with a well-trained army of investigators. What has been done is small in comparison with what should be done in the next 100 years.

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**Electricity, Thermo.** If a strip of copper and a strip of bismuth be soldered together, and heat be applied to one of the junctions, a current of electricity is generated, flowing in the direction of the arrow, from the copper to the bismuth. If cold be applied to the junction, the current flows in the opposite direction. The electricity thus evolved is called thermo-electricity.

**Electricity, Voltaic,** the branch of electric science to which an experiment by Galvani gave birth. His wife, who was making soup from frogs, happened to put them after being skinned in proximity to a charged electrical machine belonging to her husband. On touching them with a scalpel their legs became greatly convulsed. Galvani on his return was told what had occurred, and repeated the experiment on several occasions. He united the lumbar nerves of a dead frog with its crural muscles by a metallic circuit. He came to the erroneous conclusion that animal electricity existed in the nerves and muscles of frogs, etc. In this explanation Galvani ignored the metallic connecting wire. His contemporary, Volta, gave attention to this, and found that the contraction of the limbs is more energetic when the connecting arc is made of two metals instead of one. He therefore inferred that the metals took the active part in producing the contraction, and the disengagement of electricity was due to their contact, and that the animal parts constituted only a conductor, and at the same time a very sensitive electroscope. In 1793 he published these views, and in 1800 first described and constructed what has since been called after him the voltaic pile. Febroni observing that the disks of zinc in the pile became oxidized in contact with the acidulated water, considered, as did Wollaston and Davy, that the oxidation was the chief cause why electricity was disengaged. Now voltaic piles have nearly given place to voltaic or galvanic batteries. See BATTERY; ELECTRICITY; GALVANI; MAGNETISM; PRIMARY BATTERIES.

**Electric-light Bug.** See FISH-KILLER.

**Electric Lighting.** In 1800 Sir Humphry Davy discovered that if two pieces of car-

bon are joined by a conductor to a source of electric current, and such pieces momentarily touched together, so that the circuit is complete, and a flow of current established; upon their separation for a short distance, a flame is emitted, and, if the current be sufficiently powerful, this flame will continue, the carbon points will become intensely hot and emit a brilliant light. In separating the carbon points, the extra potential induced by the self-inductive of the current, is sufficient to leap the small air gap and thereby vaporizes a small quantity of carbon. Carbon vapor being a conductor, allows the current to flow across the gap. The vapor is of high resistance; therefore the vapor is heated to a high temperature. In 1809, Davy exhibited his arc light before the Royal Institute of London, his carbon points being charcoal from the willow, and his source of current a powerful voltaic pile. Such in its essential features is the arc lamp of to-day.

In the phenomena of the direct current between carbons, the current is presumed to flow from the positive to the negative, tearing away the particles of carbon from the positive, and depositing upon the negative electrode. The positive electrode thus becomes hollowed out, and some of the particles becoming deposited upon the negative electrode, it assumes a pointed form. The temperature of this flame of vaporized carbon is very high. In it is the most infusible substances as flint, platinum and diamond melt. The carbon points emit the larger portion of the light, and the positive point more than the negative. The resistance of the arc may vary from 1 to 100 ohms. It requires a current strength of 3 to 10 amperes, and a minimum electromotive-force of 40 to 50 volts to maintain a satisfactory lighting arc.

Davy used wood charcoal for his electrodes. And while they were of excellent quality, on account of their softness, would last only a short time. As the arc would burn away, it was necessary to continually adjust them, or the arc would go out. Therefore, it was found necessary to have carbons of sufficient density to last a reasonable time; and purity so that the light may be steady. Also to have a mechanism to automatically feed the carbons, and keep them a constant distance apart, as well as automatically bring them together in order to start the arc. Refined petroleum coke, ordinary gas coke, or lamp black is now taken for the base material, thoroughly ground and mixed into a stiff paste, dried and carbonized out of contact with the air. A very hard and uniform carbon is thus obtained, in any desired size, the usual length being 12 or 14 inches, and diameter  $\frac{1}{8}$ ,  $\frac{1}{4}$ , or  $\frac{3}{8}$  inch. Broadly, the lamps may be divided into two classes: series and multiple. Each system into two sub-divisions: the open and the enclosed.

The electric energy lost from the point of generation to the lamp may be expressed,  $W = C^2R$ .

Where  $W$  is energy in watts, dissipated as heat in conductors,  $C$  is current in amperes, and  $R$  is resistance of circuit in ohms.

Therefore, from the equation it is noted, the loss is in proportion to the square of the current,  $R$  remaining constant. Therefore, in distributing electric energy to a number of arc lamps, it is more economical to keep the current constant, and have the lamps joined in series.



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Two types of lamps were evolved to meet these conditions, as well as a generator to keep the current at a constant quantity, (1) the differential lamp; (2) the shunt lamp. In the differential lamp, the current must remain at a constant point. The main current is carried to a pair of lifting magnets, over which, but wound in opposition thereto, is a coil of high resistance, the terminals of which are cut around the arc itself, and called the shunt magnet. When current is thrown into the lamps, the main current pulls the carbons apart until sufficient potential is obtained at the arc to force current through the shunt magnet, which neutralizes the main magnet, thereby securing a balance, and maintaining the potential at the arc constant. In the shunt type lamp, the shunt magnet circuit is so arranged as to trip the clutch holding the carbon rod, thereby allowing the carbons to come together, should the potential around the arc exceed the predetermined amount. This lamp will burn upon any current strength, providing it is enough to operate the main magnet.

The conditions common to both types of series lamps are: (1) As the carbons burn away, they must be fed down gradually and not allow the potential around the arc to exceed a certain amount; usually 51 to 53 volts. (2) Should the carbon rod stick, or anything happen to disarrange the lamp, there will be a protective device or devices usually called cut outs, so the lamp will not be burned up, or the circuit opened.

Since the advent of arc lighting, there have been many forms of lamps evolved, using carbons in all forms. But at the present day all have come to practically the same style and form of lamp, with few modifications.

**Multiple Arc Lamps.**—Arc lamps may be arranged for multiple burning at 110 or 220 volts: As most cities are provided with low tension, constant potential mains, it is convenient to be able to place arc lamps upon the same system as incandescent and the motors. This style of lamp requires a large amount of copper for a given distribution for the reason given in former formula. The lamp itself is most uneconomical, as the voltage at the arc must be cut down to 50, which is absorbed in a steady resistance at the top of the lamp. The open type of lamp for multiple burning is almost obsolete.

**The Enclosed Arc.**—The open arc is now being largely superseded by what is called the enclosed arc. It was discovered that if the arc is surrounded by a small air-tight globe, it greatly modified the character of the light, and the carbon would last much longer. The small globe prevents the air from having access to the carbon, thus preventing its oxidation. When the lamp is started, it soon exhausts the oxygen contained in the globe, and if the globe is tight, the carbons will last from 80 to 175 hours. This type of lamp is now used almost exclusively for multiple burning both for alternating and direct current. The voltage at the arc is from 75 to 80 volts, and requires from  $3\frac{1}{2}$  to 6 amperes. Upon a constant potential circuit, it is necessary to absorb the difference between 80 and 110 volts with a resistance at the top of the lamp. With the alternating current lamp this reduction is obtained much more economically by means of a reactance which absorbs the excess potential. The enclosed arc is meeting with

considerable success, also on constant current circuits. They usually are operated at five amperes. The great advantage obtained is the small cost of carbons and attention. The light is considered superior to the open arc.

**The Incandescent.**—The great objection attending the use of the arc system of lighting was that the light was too intense for most purposes required inside. It could not be readily subdivided. From the earliest days of electric lighting, various inventors endeavored to subdivide the light. The idea of using continuous conductors, instead of the discontinuous as in arc lighting, was tried in almost every conceivable form. These conductors were to be heated to a white heat and rendered incandescent by the passage through them of an electric current. The great difficulty arose from the fact that to give useful results, the working temperature of the material was so near its melting point, that any slight increase in the current would destroy the conductor. In 1878 a great improvement was effected in the platinum incandescent lamp, which was obtained in a condition to safely withstand a much greater current strength. The platinum filament was placed in a vacuum, and slowly heated therein. The acclused gases were slowly liberated, and it was discovered that if a high vacuum were maintained and the wire raised to a point just below its melting point, the point of fusion was raised, and the physical characters of the melted was considerably changed. This lamp, however, was never a commercial success.

Various inventors experimented with the platinum lamp, enclosed in a vacuum, but the great improvement was made by the substitution of carbon filaments for platinum. This was done by an American, J. W. Starr, who employed plates inside a glass vessel containing a Torricellian vacuum. Many patents were taken out in all countries for lamps of various types, but none were commercially successful; many, perhaps, for the want of a cheap method of generating the electrical energy, as well as the fault of the lamp itself.

The advent of the first successful incandescent lamp dates from about 1879, when Edison gave us the carbon incandescent lamp, and from that time the growth of the incandescent electric lighting industry has been extremely rapid.

Every incandescent lamp consists of a carbon filament attached to two platinum wires; a glass bulb in which a vacuum is formed, and finally a threaded base attached to the bulb, and designed to hold the lamp in its socket.

The following is in a general way the method by which the lamps are made. The bulbs are blown at the glass factory whence the manufacturers obtain them directly. The first manipulation consists of preparing them for the filament. The nature of the filament varies with different systems. There are three kinds employed. Some (Swan) employ cotton thread; others gelatine or vitrified cellulose (Khotinski Lave-Fox); and others use vegetable fibres (Edison-Siemens). Finally, some employ a natural fibre submitted to a chemical process (Langhans Cruto Seel). Form is given to the filament according to its nature, either by means of a die, or between cylinders, or by cutting it out while in a plastic mass. The fibre thus obtained is transformed into compact carbon by prolonged baking at a high temperature in a crucible or



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by heating with the electric current itself. To give the filament homogeneity, and the desired resistance, a layer of carbon should be deposited on its surface; this deposit is effected in many ways, which are peculiar to each manufacturer. A very simple method consists in immersing the filament in petroleum, and raising it to a red heat in that liquid. The filament being cut to the desired length, Edison clamps the carbon with platinum wires, and covers the points of attachment with a layer of electrolytic copper. Lave, Fox, and Swan deposit a greater quantity of carbon there, while other manufacturers employ a special cement. Soldering to the carbon tends just now to become more and more employed. The filaments may be fixed in the bulb in two ways; either the two wires are fused into a piece of glass called the budge, which is next fused into the neck of the bulb; or else the wires are fixed separately on the edges of a glass socket, which is then fused into the bulb. A small tube is also fused to the top of the bulb in order to provide for the production of a vacuum. The exhaustion of the lamps takes place by means of mercury pumps. The vacuum obtained, the lamp is tested. Then the luminous intensity, and the resistance when cold are measured. The dimensions of the filaments vary with the luminous intensity of the lamp; they should be proportionately greater as the normal intensity of the lamp is higher. These dimensions depend also upon the specific resistance of the carbonized substance. As to the form of the section of the filament, the circular one is preferable because it presents the minimum resistance for a given surface. In Edison lamps the filaments have a section 0.3 MM by 0.1 MM, and a length when straightened out of 125 MM for 16-candle-power lamps, and 110 MM for those of 10-candle power (Paliz).

The reason for withdrawing the air from the bulb is that if the filament were heated in the air, the oxygen of the air would combine with the carbon causing combustion and consequent destruction. Even enclosed as it is in a vacuum the filament is slowly destroyed by the intense heat at which it is operated. Aside from the advantage named is the fact that there is no heat conducting medium between the filament and the globe, practically all the heat that is emitted being that which radiates from the filament (a small amount is lost by conduction through the leading-in wires). If there were any gas or vapor within the bulb it would conduct additional heat to the glass walls, and also dissipate heat by convection, so that with a given current in a given filament, the temperature of the filament would be reduced, and, therefore, less light would be obtained. The destruction of the filament referred to is not due to combustion because as just explained there is no oxygen left in the bulb. There is a disintegration of the filament by some process that has never been positively identified, or explained, the results being, that impalpable particles of carbon are deposited on the inside surface of the bulb, causing a gradual darkening of the glass, that is readily discernible.

The leading-in wires are made of platinum because that metal has the same coefficient of expansion by heat as that of glass. Were the coefficient different, they would expand more or less, and when heated crack and spoil the vacuum. Carbon is an exception to the general

rule, that almost all conductors increase in resistance when the temperature is raised. Its resistance decreases rapidly with an increase in temperature up to the red point. Thereafter, up to the white, the resistance decreases more slowly. The ordinary filament, when at its working point, has about one half the resistance as when cold. The standard filament gives out a mean illumination of 16-candle power at right angles with the axis of the lamp from base to top.

The power required for the usual 16-candle power standard lamp varies from 50 to 64 watts, depending upon the temperature at which the filament is operated. The higher the temperature of the filament, the higher the efficiency in watts per candle power, and also the shorter will be the life. The life of the filament in this way limits the efficiency of the lamp. The candle power of the incandescent lamp may be greatly increased by simply increasing its filament temperature by the simple expedient of increasing the current, but thereby shortens its life. The increase in candle power is not directly in proportion to the increase in current but considerably above it.

The following table shows roughly the relation between voltage, watts, and candle power for 16-candle-power filaments requiring normally 3.1 and 3.5 watts per candle respectively, and to be worked at 100 volts.

Column A is for 3.1 watts and B for  $3\frac{1}{2}$  watts.

Effect of insufficient and excessive voltages upon the candle-power wattage and life of an incandescent lamp filament.

Volts at terminals	Candle power	Watts		Per cent of normal life	
		A	B	A	B
96	12.6	45.5	51.7	220	247
97	13.4	46.5	52.7	179	195
98	14.2	47.5	53.8	146	153
99	15.1	48.5	54.9	121	126
100	16.	49.6	56.	100	100
101	16.95	50.7	57.2	82	84
102	17.9	51.7	58.4	68	70
103	18.9	52.7	59.5	56	58
104	19.85	53.6	60.5	45	47
105	20.8	54.5	61.4	37	39

The foregoing table shows the importance of maintaining the potential on the terminals of an incandescent lamp at the normal working point. Any slight excess materially shortens its life. As previously stated, the resistance of an incandescent lamp filament is much lower when hot than cold, approximately in the ratio of two to one. That is, the resistance is twice as high cold as when hot when at normal burning temperature. The illumination is rated in candle power, and power consumed in watts per candle measured when the lamp is giving its rated candle power, but this condition is not obtained with any incandescent lamp through a large portion of its active life. When a new lamp is placed in circuit, it will usually give the full candle power or a trifle more at the start, and the candle power will rise to a value from 5 per cent to 11 per cent higher than the rating. It soon, however, begins to fall off with a constant diminution up to the breaking point.

The rise and fall of candle power are due to changes in the structure of the filament. The resistance at first decreases allowing more cur-

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rent to flow, and consequently higher temperature and more light. This is indicated by the rise of the curve from 16.2 C. P. to 17.3 C. P. during the first 50 hours. Then the diminution of resistance ceases, and is followed by the gradual wasting away of the filament, which causes a gradual increase in resistance, by reducing its cross section. The current thus gradually falling off, taken together with the decreased surface of the filament, and the deposit of carbon upon the globe, causes the fall in candle power indicated. The decrease in candle power is not directly proportional to the decrease in current, thus the energy per candle power increases rapidly after the first few hundred hours.

In addition to the arc and incandescent, we now have also the Nernst lamp, which is of late coming into prominence as a lighting agent, and which has many valuable qualities. The Nernst lamp is the invention of Prof. Walther Nernst of Göttingen University, a leading authority in the chemical world. Prof. Nernst was making experiments as to the principles underlying the efficiency of the Welsbach gas mantle. The exact elements and their proportions of the Welsbach mantle have been more or less of a secret, but it is well-known that certain metallic oxides, such as thorium, yttrium, cerium, zirconium, glucinum, erbium, have entered into their manufacture; probably the first three mentioned being the chief ingredients. These very refractory materials are of a yellowish, or a whitish color. They are non-volatile save at exceptionally high temperatures. Prof. Nernst in his early experiments took certain of these substances, such as magnesia oxide mixed with porcelain, which is a high class insulator when cold, but he found were electrolytes when hot. These are called conductors of the second class, or such chemical substances as are decomposed upon the passage of a direct current.

An infinite amount of experimenting has been done both in America and Europe to find the most suitable substances for these electrolyte filaments, or glowers as they are called.

In order to adapt the principle to commercial lamps, there are many problems to be solved. The Nernst Lamp Company of Pittsburg, Pa., hold the American patents, and have developed a very successful lamp. The lamp consists of units of one or more glowers, each rated at about 50-candle power, and used upon 110 to 220 volt alternating current. The lamp consists of: (1) the glower; (2) the steadying resistance; (3) the heater. The resistance of the glower decreases rapidly when heated, and upon a constant potential circuit would immediately burn up were it not for a resistance of iron wire where resistance increases with the temperature, and which is adjusted to balance the decrease in resistance of the glower. The glower when cold is a non-conductor, and, therefore, must be heated before it will conduct the current. After once started the current will maintain the temperature at the conducting point.

The Nernst Lamp Company have arranged that by surrounding or placing in close proximity thereto to a heater, which consists of a coil of platinum wire so arranged that the current is first switched into the heater, which heats the glower to the conducting point. The heater is then switched out.

On account of the very high temperature of the Nernst lamp glower the efficiency is very high. The light is very pleasing; in color it stands midway between the yellow and red rays of the incandescent carbon lamp, and the violet and blue of the arc lamp. It is, however, so dazzling white it is usually placed in ground glass globes.

The electric arc and incandescent lamps are the most efficient practical transformers of the energy of fuel and water to light, which we have.

The following table gives the mechanical equivalent of the most common lights:

Candles .....	86	watts	per	candle.
Oil lamp.....	57	"	"	"
Petroleum lamp.....	48.8	"	"	"
Bats wing gas burner.....	93.2	"	"	"
Argand .....	68.8	"	"	"
Siemens intensive burner 230 candle power.....	45.6	"	"	"
Incandescent lamp 16 C. P..	3.5	"	"	"
Arc lamp.....	.8	"	"	"

The eye is affected by waves of the ether whose length are included between .810 Y and .36 Y. All vibrations of a wave length above or below the points named do not effect the eye as light, and are, therefore, useless and represent so much wasted energy.

The quantity, therefore, of energy radiated from a source of light is composed of two parts: (1) the energy affecting the eye, or vibrations between the limits of 360 Y and 760 Y; (2) the vibrations above and below .360 Y and .760 Y, and the total energy expended is  $Z = X + Y$ .

The ratio  $\frac{X}{Z}$  of the energy of the luminous radiators to that of the totality is called the optical efficiency of the source. There are two methods used in securing this efficiency: First, passing the rays emitted by the source successfully through a layer of bisulphide of carbon, which allows all rays to pass, and through an equal layer of alum solution, which allows only luminous rays to pass. The intensity of the radiators is measured by a thermo-electric pile. The second method, which is of great exactness, can be only employed for incandescent lamps. The lamp is placed in a calorimeter with the blackened copper sides filled with water. The whole of the heat radiated is absorbed by the water and metallic sides of the calorimeter. The elevation of temperature of the water is then measured in unit of time. The calorimeter is then replaced by one of thin glass, which in this case, absorbs the obscure rays alone. It is said by this method an exactness of .3 per cent is easily obtained (Paliz).

The following table shows the results obtained by various authorities upon the optical efficiency of various sources of light:

Designation of light source	Per cent Optical Efficiency	Authority
Hydrogen flame	.00	Tyndall
Oil lamp	3.00	"
Ordinary gas burner	4.00	"
Swan Lamp 16 C. P. run at 2.6 C. P.	2.3	Blattner
" " " " 9.2 "	2.8	"
" " " " 13.2 "	3.6	"
" " " " 20.6 "	5.2	"
Edison " " " 4 "	3.6	"
" " " " 8.3 "	4.5	"
" " " " 17 "	6.2	"
" " " " 28.6 "	8.5	"

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Designation of light source	Per cent Optical Efficiency	Author-ity
Bernstein 32 C. P. run at 15 C. P.	4.2	Blattner
" " " " 30 " "	6.5	"
" " " " 50 " "	7.3	"
" " " " 90 " "	9.9	"
Arc Lamp inclination 0°	8.4	Nankano
" " " 10°	12.4	"
" " " 20°	17.4	"
" " " 30°	18	"
" " " 40°	18.2	"
" " " 50°	19.8	"
" " " 60°	5.5	"
" " Spherical Efficiency	16.6	Nichols
Magnesium Lamp	15.	"
Geissler Tube	32.7	"

### Mechanical Equivalent of Light.

1 — candle power — { .2713 watt.  
12 foot lbs. per minute.  
(Stillman) { 720 foot lbs. per hour.

The low value of the common radiants is due to the fact that they are based upon the incandescence of carbon. We have made immense strides in the cheap production of electricity, but the advance in the transformation of the electric energy to light has not been so rapid. From the transformation of the energy of the coal to light through the medium of the furnace, steam boiler, and engine to electricity and to light, the greatest loss occurs in the last transformation, as the following example will show:

The ordinary steam boiler and furnace, when intelligently operated absorbs from 70 to 80 per cent of the heat energy of the coal, and in a modern triple expansion condensing engine will give or transform 15 per cent of the energy in the steam to mechanical, and in ordinary good practice will run from 2 to 3 pounds of coal per horsepower hour. The electrical generator will transform at 92 to 93 per cent of the mechanical to electrical, and this will be delivered to consumers at 95 per cent, or a loss of 5 per cent.

We, therefore, will have delivered to the consumer approximately 10 per cent of the theoretical energy of the coal. If the conversion to light is through the medium of the incandescent lamp, we will throw away 95 per cent of this energy, and secure as light only  $\frac{10}{100}$  or practically 1 per cent of the energy of the coal. Such are the extravagant methods of the 20th century in spite of our boasted progress.

### ELECTRIC LIGHTING COMMERCIALLY.

A perfect light should possess the following qualities:

**Purity.**—It should not consume or pollute the air.

**Brightness.**—It should be soft and brilliant.

**Cleanliness.**—It should be harmless to furniture, books, pictures and decorations.

**Coolness.**—As it is light, and not heat that is required, the less heat given off the nearer the light will approach perfection.

**Convenience.**—It must be readily available whenever required, and should be unaffected by draughts.

**Easy Distribution.**—It must be available wherever and in whatever quantity desired.

**Safety.**—It should be free from all risk of fire.

How far do the present illuminants, namely, gas, oil, and candles, comply with the foregoing conditions?

The following table shows the oxygen consumed, carbonic acid produced and air vibrated by the combustion of certain bodies producing the light of 12 standard candles each burning 120 grains per hour.

Light Producing Material Equal to 12 Standard Candles	Cubic Feet Oxygen Consumed	Cubic Feet Air Consumed	Cubic Feet Carbon Acid Produced	Cubic Feet Air Vitrated	Heat, lbs. of Water Raised 10° F.
Cannel Gas....	3.30	16.50	2.01	217.50	195.
Common Gas....	5.45	17.25	3.21	348.25	278.6
Sperm Oil.....	4.75	23.75	3.33	356.75	233.5
Benzole .....	4.46	22.30	3.54	376.30	232.6
Paraffin .....	6.81	34.05	4.50	484.05	361.9
Sperm Candles.	7.57	37.85	5.77	614.85	351.7
Wax .....	8.41	42.05	5.90	632.25	383.3
Tallow .....	12.	60.	8.73	933.	595.4
Electric .....	None	None	None	None	13.8

### LIGHTING BY GAS.

**Purity.**—It is not pure, as it both consumes and pollutes the air. Each 12-candle-power gas burner consumes  $5\frac{1}{2}$  cubic feet of oxygen, and liberates 350 cubic feet of CO<sub>2</sub> per hour.

**Coolness.**—It is not cool—the heat produced in one hour by a single ordinary gas jet being sufficient to raise 280 pounds of water 10° F.

**Cleanliness.**—It is not clean—each 12-candle-power jet giving 3.2 cubic feet of carbonic acid gas per hour in addition to sulphur fumes, which will blacken silver. It also gives off a considerable amount of soot, the evidence of which is soon seen in blackened ceilings, cornices, discolored wall paper, etc.

**Convenience.**—It fairly meets this requirement, being available wherever required, but fails in so far that it cannot be lighted without another agent, the aid of a match or taper. It is also affected by draughts, causing it to flicker and smoke, while the unequal light is injurious to the eyesight.

**Easy Distribution.**—The fact that owing to the great heat it gives off, it is not safe to place it near any inflammable substance, necessitates its being in the center of the room at a considerable distance from the ceiling.

**Danger.**—Scarcely a day passes without some published account of terrible explosions causing loss of life and property. Gas, therefore, fails to fulfil the conditions of a perfect light. Oil lamps and candles fail entirely, and for such obvious reasons they are scarcely worth enumeration.

In the electric incandescent light, however, we find the almost perfect light.

**Purity.**—It is absolutely pure, there being no consumption, nor pollution of either air or oxygen. There are no waste products of any sort, and, therefore, no smell.

**Brightness.**—The incandescent light is white, soft and brilliant, but not necessarily dazzling.

**Beauty.**—An incandescent lamp being in itself a beautiful object requires no external decoration.

**Cleanliness.**—It is perfect in this respect, no smoke, soot or fumes of any sort being given off.

**Coolness.**—For the same light heat given off

## ELECTRIC LOCOMOTIVE — ELECTRIC PIANO

is one twentieth that given off by gas, and about one fortieth that given off by tallow candles.

**Convenience.**—It is readily available whenever required. The lamps can be placed in any position, pointing upward, downward or horizontally. It can be placed close to the most combustible substances. It is lighted without match or taper. A room can be lighted by a movement of the finger before entering, and left in darkness by the same movement on leaving it. A passage can be lighted in front of you as you go along, and the light extinguished behind you as you proceed. It is perfectly unaffected by draughts, and will burn, if required, under water.

**Safety.**—There is no danger in connection with electric light if the work is put in the hands of firms of standing repute. Matches and tapers are not used, and there is no liability of asphyxiation, or explosion like gas.

The electric incandescent light is, therefore, the most perfect light we have for purity, brightness, cleanliness, coolness, convenience, easy distribution and safety. **WALTER H. JOHNSON,**

*President Edison Company of America.*

**Electric Locomotive.** See **TRACTION, ELECTRICAL.**

**Electric Log,** an electric circuit through the log-line to the detent of an escapement in the register-log, so that by touching a key on deck a circuit may be completed, an armature attracted, and thus the starting and stopping of the mechanical register in the log be exactly timed.

**Electric Loom,** electricity used as the motive power for a loom. In 1852, an electric loom was exhibited by Bonelli at Turin. The invention was at that time in a crude state, but has since been much improved. The object is to dispense with the perforated cards required in the Jacquard apparatus. See **LOOM.**

**Electric Machine,** a machine for exciting electricity by means of friction. Its inventor was Otto von Guericke, of Magdeburg, who made one, consisting of a sulphur globe, about 1647, following it by the air-pump about 1650. Sulphur was next exchanged for resin, which in turn was superseded by a glass cylinder. Von Guericke's "rubber" to excite electricity had been simply his hand. Instead of the hand Winckler, in 1740, introduced cushions of horsehair stuffed with silk. Bose, about the same date, collected the electricity on an insulated cylinder of tin plate. Ramsden, in 1760, replaced the glass cylinder by a circular glass plate. The glass is rotated between the surfaces of the rubbers, and the electricity which is generated passes to the conductors on each edge of the disk, thence to the prime conductor, and finally to a Leyden jar, or other object, as may be desired. By friction with the glass, the glass becomes positively and the rubbers negatively electrified. The latter communicate with the ground by means of a chain, which carries off the negative electricity as soon as it is produced. In Nairne's machine there is a cylinder which is rubbed by only one cushion. Armstrong's is a hydro-electrical machine. In Holtz's the electricity is not developed by friction, but is induced by the constant influence of an already electrified body. It is an old invention revived and improved, and the

principle has been carried still further by the admirable machines of Voss and Wimshurst. All dynamo-electric machines or generators, whatever their peculiar forms, as distinct one from the other, are based upon the discoveries of Faraday, and Henry contemporaneously in 1832, that if a closed wire or conducting ring is moved across a magnetic space, a current of electricity is generated in the wire. A dynamo-electric generator is the best apparatus devised for the application of this principle to the production of an electric current. A magnetic space is provided between the poles of two or more powerful magnets, and coils of wire are caused to traverse this magnetic space in such a way as to excite a current in them. The stronger the magnetism of the space, the longer the wire and the quicker it is moved, the stronger will be the current excited. See **DYNAMO**; **ELECTRICITY.**

**Electric-magnetic Machine.** There have been constructed a number of machines for the development of electricity by magnetism. These are termed "magneto-electric machines," and are largely used by the medical profession. In some machines it is desirable to have a continuous flow of electricity. To accomplish this what is called a "commutator" is used. This is an arrangement by which at the proper moment the contrary current is made to flow in the same direction as the other. See **ELECTROTHERAPEUTICS.**

**Electric Microphone,** an instrument that depends for its action on the extreme sensitiveness of mercurized carbon to the passage of electricity. The feeblest tremors or vibrations of the sound-board affect the carbon pencil and make it vibrate in its sockets. This causes a variable flow in the electric current, by which also a variable effect is produced on the magnet in the telephone. The disk is thus made to partake of the same vibrations as originally proceeded from the sound-board. From the character of the instrument in the way of revealing feeble sounds, it has been applied with success by medical men and physiologists toward detecting any derangement in the functions of the body. See **ELECTROTHERAPEUTICS.**

**Electric Motor,** a machine by which electrical energy supplied from an external source is converted into mechanical energy. See **DYNAMO**; **ELECTRICITY.**

**Electric Navigation.** Vessels of small draft are now propelled by electricity. The power drives a motor, which actuates a screw propeller. The current is generally supplied by a storage battery. From their noiselessness electric boats are peculiarly available for nocturnal torpedo operations, and the universal equipment of modern warships with electric lighting and power plants makes their use possible at all points. This type is often termed an electric launch, and most or all electric boats fall under this category. See **ELECTRIC STORAGE BATTERY.**

**Electric Organ.** See **ORGAN.**

**Electric Pendulum,** a form of electroscope consisting of a pith-ball suspended by a non-conducting thread.

**Electric Phonograph.** See **PHONOGRAPH.**

**Electric Piano.** See **MUSICAL INSTRUMENTS.**

## ELECTRIC POLICE SIGNALS—ELECTRIC SIGNALING

**Electric Police Signals.** See **ELECTRIC SIGNALING**.

**Electric Power.** See **DYNAMO**; **ELECTRICITY**; **POWER**.

**Electric Railroad.** See **TRACTION, ELECTRICAL**.

**Electric Railroad Block Signals.** See **ELECTRIC SIGNALING**.

**Electric Repulsion,** the mutual tendency of similarly electrified bodies, or similar electric charges, to repel one another.

**Electrics and Non-electrics.** The chief work of the earliest experimenters in electricity was to divide bodies into electrics, which they could excite by friction, like amber (Greek amber); and non-electrics, such as the metals, which they could not so excite. These names were given to the two classes by Gilbert of Colchester (1600). But Du Fay (1733-45) showed that electrics are identical with non-conductors, and non-electrics with conductors; and that the reason why non-electrics did not exhibit excitement by friction was that the electricity was conducted away from them as fast as it was produced. The distinction was thus broken down. See **ELECTRICITY**.

**Electric Signaling.** While it is true in a broad sense that any method of communicating intelligence to a distance is embraced in the term telegraphy, in the present instance the term electric signaling will be employed to cover the signaling systems and methods described in this article. This term is perhaps the more appropriate inasmuch as certain of the systems to be outlined in reality partake more of the nature of mere signals than of a means of transmitting intelligence as that term is generally understood. Almost without exception electro-magnetism is employed in the operation of electric signals. See **ELECTRO-MAGNETISM**.

*The Electric Door Bell.*—This is perhaps the best known and one of the simplest methods of electric signaling. In its operation it employs a primary battery, a push button at the door, a vibrating bell within the house, and a wire connecting the push button and the bell. The bell and its armature, the connecting wire, the push button and the battery comprise the electric circuit. The push button is merely a key consisting of two strips of metal which when pressed together allows the current to flow. The electric bell consists of a coil of wire wound around a soft iron core. Its armature carries at its free end a small hammer which, when the armature is attracted, strikes against a small gong, ringing it. The vibration of the hammer is brought about by a very simple device. Normally the armature rests against a contact point which is a part of the circuit; the armature itself also being a part of the circuit. The circuit is normally open at the push button. When this button is pressed the circuit is closed and the armature of the bell is forthwith attracted, its hammer striking the gong at that instant. In the act of moving forward, however, the armature leaves the contact point against which it had been resting, with the result that the circuit is opened at that point. This has the effect of permitting the iron of the bell to lose its magnetism, whereupon the armature falls upon its contact point, again closing the circuit with the result that the armature is again attracted, which

action is continuously repeated so long as the push button is pressed in. A small spiral or tension spring suffices to keep the push button normally open.

*Annunciator Signals.*—The "annunciator" or call-bell systems so generally used in hotels and offices utilize the principle of the door bell. Annunciator systems in fact might be termed multiple electric door-bell systems. Usually a wire runs from each room to a central point or office where the annunciator is placed. This annunciator contains within its case a small electro-magnet for each room. One battery is caused to supply the current for all the circuits by simply connecting the wire from each room to the terminals of the battery. In a similar way one bell at the annunciator is caused to respond to all the calls that come. The armature of each electro-magnet within the case carries a small shutter, on which is placed the number or letter of the room with which it is connected. This shutter is held out of sight by means of a small catch hook attached to the armature of the magnet until the push-button in a given room is pressed, whereupon the armature is attracted, releasing the shutter, which instantly drops, showing the number. At the same time the annunciator bell rings, directing the attention of the clerk to the call. In other forms of annunciators the falling of the armature is caused to deflect a small arrow on the face of the case, beneath where is marked the number, name or letter of the room. There may be almost any number of rooms from 1 up to 100 or more connected with one annunciator. In practice one wire is usually run from the battery and annunciator to each room. This is called the "common return" wire. A separate wire, as stated, in addition is run from each room from the common return wire through the push button to the electro-magnet in the annunciator, thereby supplying a separate circuit for each room.

*Burglar Alarm Signals.*—For simple domestic purposes the arrangement employed for burglar alarm signals is also closely akin to the systems just described, the main difference being that the finger push-button is replaced by a circuit closing contact in the frame of a window or the jamb of a door. To bring about the result desired the circuit closer is placed on the frame of the window in such a way that the movable portion of the circuit closer projects beyond the surface of the window frame. The contacts of the circuit closer are held apart normally by a simple spring. In order that when the window is closed this projection may not be depressed, a piece is cut out off the window sash at a point directly opposite the projecting circuit closer. In an analogous manner the circuit closer is attached to a door jamb. The wires leading to the circuit closer are concealed behind the woodwork. When a window is raised or a door is opened by an intruder the contact points of the circuit closer are brought together whereupon the annunciator bell is rung, giving the alarm, and at the same time the room where the door or window has been opened is indicated by the dropping of the corresponding shutter in the annunciator. The annunciator is located in any desired part of the house, usually in a bedroom. The method described is termed an open circuit method. In such systems what is known as open circuit batteries,

## ELECTRIC SIGNALING

such as the ordinary dry batteries, or the wet Leclanché batteries may be used. In some cases, to guard against a momentary opening of a door or window, such as would only occasion a short ring of the alarm bell, not sufficient perhaps to arouse a sleeper, an auxiliary arrangement is provided at the annunciator consisting of a drop arranged to close the bell circuit continuously until the drop is re-set. A small switch is provided near the annunciator by means of which the alarm circuit may be opened during the day-time so that needless alarm may not be given by the ordinary opening of windows. Other switches are also used for the purpose of testing the various circuits to see that they are in proper working condition.

*Central Office Burglar Alarm System.*—This system, as the name implies, relates to one in which the ringing of an electro-magnet alarm in a central office will announce the presence of intruders in the building or buildings in which the protecting apparatus is installed. The central office may be any convenient distance from the protected buildings. These systems are frequently termed electric protective systems. The plan usually adopted is to run a net-work of wires through partitions, across floors, skylights, etc. These wires are part of a circuit extending to the central office, and the said wires are so connected with the circuit that any interference with them, after they have been "set," will cut out a high resistance, consisting of a coil of wire, suitably placed in the circuit of the protected building. The cutting out or short-circuiting of this resistance will so increase the strength of the current in the circuit as to operate a "double-balanced" instrument in the central office. If on the other hand the resistance is not "cut out," but instead the wires of the circuit be cut or broken, by accident or design on the part of intruders, the consequent absence of current, or even a slight decrease of current, will likewise cause an alarm in the central station. The double-balanced instrument at the central office is usually a relay, the armature of which carries a needle that normally stands at a zero point, from which point it may be deflected in either direction. An increase of current on the circuit deflects it in one direction—a decrease of current allows a spring or weight to deflect it in the other direction. In either case the alarm is given when the needle moves and an attendant is despatched to the premises from which the alarm has emanated. Each relay is of course suitably numbered or otherwise designated in the central office so that the building with which it is connected is known.

*Telegraph Message Service or Emergency Signals.*—This service relates to the supplying or calling of messengers, policemen, firemen, etc., at the call of or by a "subscriber," in whose house or office a "call box" has been placed. This call box is electrically connected by means of a wire with a central office at which the messengers are located, and from which office communication with police and fire headquarters can quickly be made. Each call box is numbered and is supplied with what are termed "make and break" attachments which are set in operation by the turning of a crank on the cover of the box. These attachments, when thus operated, transmit automatically to the

central office the number of the box, which at once indicates to that office the location of the signaling box. The construction and operation of the call box are as follows: A crank is mounted rigidly with a recoil spring on a shaft. On this shaft is also mounted, but loosely, a cog-wheel. A "break-wheel," having a number of slots in its periphery, is geared with the cog-wheel in such a manner that it receives a tendency to turn in a given direction, but it is normally prevented from turning by the engagement of a pin on its side with a curved cam which is attached to a prolongation of the crank arm. When, however, the crank lever is turned to, say the right preparatory to sending in a call, the cam is automatically moved out of the path of the said pin and the break-wheel is then free to move. By a suitable pawl and ratchet, the cog-wheel is prevented from moving when the crank is turned to the right. The effect of turning the crank is to wind the recoil spring. When the crank is let go the spring unwinds and turns with it the break-wheel which completes a revolution; at the end of which it is again held by the pin as before. The break-wheel is made part of the circuit leading from the box to the central office. A flat metal spring which is also part of the said circuit rests on the periphery of the break-wheel in such a manner that when the wheel is making its revolution the spring falls into the slots on the said periphery and opens the circuit as many times as there are slots provided. If, for instance, the number of a given box is 24, there will be cut on the periphery two slots in close succession, then an interval of unbroken metal surface followed by four slots in succession. The circuit in such a case, as the wheel rotates, will be opened twice in succession, closed for an interval, and then opened four times in succession, with the result that a bell at the central office will give out, first two strokes, and then four strokes, on its gong. A large number of such boxes can be placed on one circuit without causing confusion. The call box just described suffices to send in a swift call for a messenger. When it is desired to make it possible to call a policeman, doctor or fireman by the same type of box, it is provided with a "stop" that projects through the cover in such a way that the crank cannot be moved beyond a certain point. The ordinary position of the "stop" would be at the messenger call, in which case the number of the box only would be sent in when the crank is turned. If, however, a doctor should be desired, the stop is moved to a point marked "doctor," on the cover of the box and in turning the crank it is moved up to that point. This farther movement of the crank has the effect of bringing into operation one or more additional slots on the periphery of the break-wheel in consequence of which the box number is preceded by one or more single strokes on the bell, which indicate to the central office attendant that a doctor, fireman or policeman, as the case may be, is desired.

*Fire Alarm Telegraph Signals.*—The importance of electricity as a time saver in announcing the existence of a fire can scarcely be overestimated. A special feature of the electric fire-alarm system is that it not only gives the alarm, but also indicates to the firemen the location of the fire, or within a very short distance thereof. It may be noted that a simple fire alarm system is



## ELECTRIC SIGNALING

in many respects similar to the systems just described, in that it consists of a central office or station in which alarm apparatus and battery are located, and of signal boxes in the street and elsewhere by which to transmit alarms to the central office. A wire connects the central station with the various signal boxes in the streets and fire-engine stations. In each signal box is placed a break-wheel, practically similar to that used in the call-boxes of the district messenger or emergency service; the main difference being that owing to the more exposed position of the fire alarm boxes, and their greater relative importance, more substantial boxes are employed. In general these signal boxes are supplied with an inner and outer door to protect the apparatus from the elements. The signal boxes are provided with a crank or a hook which on being operated causes an alarm to be sent to the central station giving the number of the box from which the call has emanated. The signal box is also provided with a small electric gong, which rings each time the circuit is opened. This intimates to the one sending in the alarm that the alarm is being properly transmitted. It also serves the purpose of intimating to any one who might open an adjacent box to send in an alarm therefrom, that the alarm is already being sent, thus preventing interference. At the central station and the various fire stations a gong is struck a number of times corresponding with the number of the box from which the alarm emanates. In the same circuit also an ink-recording register in the central office marks on a paper strip the number of the signaling box, thus giving a permanent record of such alarm. Inasmuch as it is not good practice to put more than 25 or 30 signal boxes on one circuit, but yet is very important that all the fire stations in a given district should receive the alarm, a repeating device is utilized at the central station which receives the alarm from any one of the circuits and thereupon repeats it automatically to all the other circuits.

*Automatic Fire Alarm Signals.*—In many of the large cities of the United States an auxiliary to the regular fire alarm system, consisting of some form of thermostat included in a circuit in the building to be protected, is employed. This system again is somewhat analogous to the messenger telegraph system described, the chief difference being that in the one case the signal box is manually operated, while in the other case an increase of temperature, due to fire, by affecting the thermostat causes the alarm to be transmitted. Thermostats are of different types. One type consists of a crescent-shaped spring, made up of two strips of metal, steel and copper, one over the other. One end of the spring or strips is fastened to a support, the other end is adjacent to a contact point of an electric circuit. As the metals named do not expand equally under increased temperature the spring as a whole bends when the temperature increases, and the movable end makes connection with the contact, thereby closing the alarm circuit with the result desired. Other types of thermostats are made of easily fusible alloys. Still another form of thermostat consists of a drum-shaped box, holding substances which have a high expansion under increased temperature. The expansion causes the ends of the box to bulge, thereby closing an alarm circuit.

*Police Electric Signals.*—These may be considered as more or less amplified fire alarm systems, consisting as they do of signal boxes placed on poles and in booths along the routes of the policemen; from which boxes signals of all kinds may be transmitted to and from police headquarters. The signal boxes are connected by a suitable wire with headquarters; and each box has a break wheel, carrying the number of the box. A telephone outfit is also placed in the box by means of which the policemen may converse with the main station. In fact the telephone is used nearly exclusively, the policeman as he arrives at a signal box sending in a signal which intimates to the attendant at headquarters the number of the box at which he has arrived in the course of his beat, whereupon the attendant communicates with the policeman and takes his number, thus getting a record of his whereabouts. If the officer desires to send in a special signal of any kind, as for an ambulance or wagon, or for assistance, he can do so by a special arrangement within the box. In some cities certain citizens are supplied with keys of the signal boxes. Such citizens are authorized to send in signals for police assistance in cases of emergency, and thus the police force is practically augmented by a volunteer service.

*Railway Electric Block Signals.*—A block system in brief consists of a means of showing manually or automatically certain signals which indicate to the engineer of a train that a certain portion or section of the track before him is "clear" or occupied. The road is divided into sections or blocks which are of various lengths depending in a great measure on the topography of the route, and the amount of traffic. The length of a block varies from 600 feet to several miles. The signals employed in a "block" are either "safety," "caution," or "danger," represented by a white light or sign, a green light or sign, and a red light or sign, respectively. The sign usually consists of the well-known semaphore arm. In automatic electric systems the circuits and apparatus are generally so arranged that the entrance of a train to a "block" sets the danger signal and that signal is displayed until the train passes out of that block into the next, when the danger signal is lowered and the caution signal is shown. When the train passes into a second block ahead the caution signal is lowered and safety is shown. The part assigned to electricity in the operation of these signals consists generally of actuating electro-magnets which are placed in circuits capable of being opened, closed or short-circuited by the signal or car wheels of a train, which electro-magnets are caused directly or indirectly to operate the various signals. In what is known as the Union Switch and Signal Block system, the semaphores are operated against gravity or a counterpoise by compressed air. This air is compressed by a compressor and is conveyed along the track in an iron pipe. A cylinder and piston are suitably arranged on each semaphore pole, the piston being attached to the semaphore arm in such a way that it may operate the arm as the piston rises and falls. The compressed air is let into the cylinder by valves under control of electro-magnets, which in turn are controlled by the track circuits, the latter, as stated, being controlled by the car wheels of a train. The compressed air effects the downward movement of the semaphores against the weight of a counter-

## ELECTRIC SMELTING—ELECTRIC STORAGE BATTERY

poise. At this time the signal is at safety. If therefore the air supply fails or the electric apparatus or valves in any way become inoperative, the counterpoise brings the semaphore to the danger position. Another electric block system, known as the Hall Railway Signal System, uses a disk enclosed in a drum-shaped box on the top of a pole. This disk is operated by an electromagnet, the latter being attracted by an electric current which is under control of the engine, the latter operating, as it passes, a heavy current closer by the side of the track. There is one of these current closers at the beginning and end of a block. The engine thus sets the signal to danger as it comes into a block and sets it at clear as it leaves the block. In the more recent installations of electric block systems the semaphores are operated by electric motors contained in the base of the semaphore pole. These motors do away with the need of compressed air. A device named the Miller Cab signal is different from the foregoing systems. It consists of suitable apparatus and battery for operating certain electric lights in the engine cab. Normally a white light is burning, but when there is another train on the block in which the train enters, the circuits are so operated that the white light is cut out of the circuit and a red light is lit up in its place. This of course notifies the engineer of the near proximity of another train.

For a more detailed and illustrated account of the foregoing systems, the reader may be referred to the author's 'American Telegraphy and Encyclopædia of the Telegraph.'

WILLIAM MAVER, JR.,  
*Author of 'American Telegraphy.'*

**Electric Smelting.** See METALLURGY.

**Electric Storage Battery, The.** The principle of the electric storage battery was known as far back as 1801, for in that year Gautherot discovered the secondary current obtained from a cell which consisted of two silver or platinum electrodes immersed in a common salt solution. He first charged the cell by passing a current through it; then breaking the charging current, he connected the two plates to the terminals of a galvanometer and obtained a momentary deflection, indicating a flow of current in the reverse direction to the original charging current. This, then, may be said to have been the discovery of the principle of the storage battery, but it was nothing more, since 41 years elapsed before anything noteworthy, more, was done toward its development. In 1842, however, Sir William Grove constructed his famous gas battery, which was a long step ahead in the direction of a commercial accumulator. Grove's battery consisted of a pair of platinum strips immersed in dilute sulphuric acid, each strip surrounded on the top and sides by a closed glass tube which collected the gas developed in charge, and kept each gas in contact both with its respective electrode, and with some of the adjoining acid surface. If this apparatus, after having current passed through it for some time, be connected to a galvanometer, it will yield a small current in the reverse direction for a considerable time, or until the oxygen and hydrogen developed by the charge have gradually become absorbed by the platinum and have recombined to form water. It will be seen that this cell was a very great advance over the experiment of Gautherot, but

yet it was absolutely without practical value as a storage battery, and a great deal of thought and labor expended since Grove's time have failed to further develop it.

It remained for one Gaston Planté, a Frenchman, in 1860, to make the one more important step which immediately demonstrated the wonderful possibilities of the storage battery, and which set other inventors to work all over the world. His experiment consisted in making a cell which had lead strips immersed in dilute sulphuric acid instead of platinum, as was used by Gautherot; this cell being charged by a current would yield a very considerable reverse or "secondary" current. Planté's important discovery, however, was that each time such a cell was charged and discharged the amount of the secondary current, or the "capacity," of the cell increased; and further experiments showed that by not merely discharging the cell but by charging it up in the reverse direction each time, the capacity was brought up even more rapidly. Planté was thus enabled to make secondary cells having enough capacity to give them great commercial importance, and since the changes and improvements which have been introduced since his time are all directly along the same lines and all involve the same fundamental principles, it is eminently fitting and proper that to Planté has been attributed the honor of inventing the storage battery. Examining his results carefully, Planté found that the lead plate which was connected to the carbon or negative pole of the primary battery, became coated with a film of dark brown peroxide of lead, and the lead plate connected to the zinc terminal of his primary cell was coated with spongy metallic lead. Each time the current in the secondary cell was reversed a little more of the solid metallic lead of the plate became peroxidized, and the gradual accumulation of this film of "active material" on both plates, caused the increase in capacity. Planté arranged a large series of cells through which he continually passed a current, first in one direction, then in the other, the duration of the charges gradually increasing, and by this treatment, in course of time, his plates accumulated a considerable thickness of active porous lead and lead peroxide upon their respective surfaces, and after one or two months of the treatment (which he called formation) were ready to be used. It will readily be seen that this forming process for converting the solid lead into active material was very troublesome and expensive, and it was in overcoming this difficulty that the next great step ahead was taken. While Planté's batteries might have been of great commercial value, the very limited use of electricity at that time necessarily curtailed its usefulness very much, and it was not until the development of the dynamo that the real need for a storage battery was felt. It was in response to this need that Camille A. Faure, in 1881, patented a method for making storage batteries, by which the long forming process of Planté was entirely obviated. Instead of chemically attacking the surface of the metallic lead plate, Faure covered the surface with lead oxide in the first instance. A single charge then was sufficient to convert this into lead peroxide upon the one plate and metallic lead upon the other. This invention, which is virtually the last great stride toward the perfection of the storage bat-

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tery, is commonly credited to Faure, but incorrectly so, since Charles F. Brush, in America, working independently of Faure, arrived at the same principle at almost the same time, so that in this country priority was given to him, and it is Brush's patent which has ever since controlled the so-called "pasted" plate throughout the United States. All battery plates made to this day are either after the Planté type, where part of the metallic lead plate is chemically acted upon to produce the active material, or else after the Faure-Brush, or pasted type, where the active material, usually in the form of an oxide of lead, forms an integral part of the original plate. It must not be understood from this that no improvements have been made in recent years, but rather that each improvement taken singly has been of relatively small importance, and that the vast number of these, and the constant perfection of detail, have collectively made an immense difference to its practical performance.

a few years' experience it was found that neither of these two expedients was sufficient for practical purposes, and many inventors set to work to construct grids which would effectively retain the active material, and particularly the lead peroxide upon the positive plates. The number of different forms of grid thus brought out almost surpasses belief, and a few only of the most important are here illustrated (Figs. 1 to 9).

These examples, selected from among the types of pasted plates which have been most successful, show the general tendency toward that construction of grid which will have the best grip upon the active material and which will make it as difficult as possible for the latter either to lose electrical contact with the grid or to fall to the bottom of the cell. In some cases, as the Tudor plates illustrated, the grids after being cast have been passed through rolls which turn over a part of each fin so as to give it a grip on the material; in other cases the grids



Fig. 1.—Faure.



Fig. 2.—Brush.

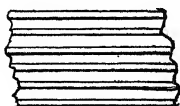


Fig. 3.—Swan.

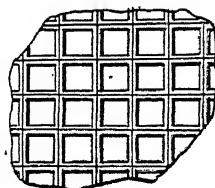
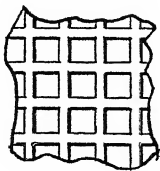


Fig. 4.—Bradbury & Stone.

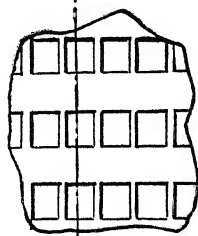


Fig. 5.—Hagen.

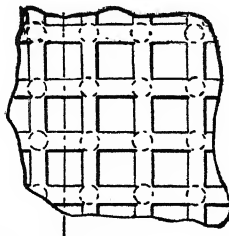
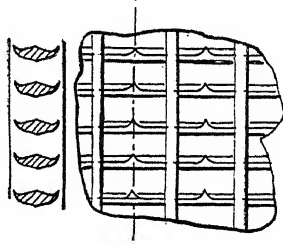


Fig. 6.—Tudor.



Figs. 1 to 12 are types of grid for pasted plates. Shaded portions represent lead, unshaded portions active material.

Some of these refinements of design and detail are as follows :

Faure's original plates consisted of plain sheets of lead, sometimes roughened on the surface, upon which was spread or pasted the lead oxide intended to become active material. It was soon found, however, that in practice this arrangement was entirely inadequate, since the lead peroxide on the positive plate quickly lost its hold upon the supporting sheet and fell away from it.

In order to meet this difficulty, Swan, in England, and Brush, in America, at about the same time, devised a variety of grid plates, whose object was to provide means of locking the material fast. These grids were either like a flat plate with a number of deep grooves extending into its surface (Fig. 2), or else like a flat plate having a number of holes entirely through it (Fig. 3); the lead oxide intended to become active material being worked into the openings in either case and there held by the large surface of contact with the grid. But with

have been cast with holes bigger in the middle section than at either surface; and in still others, notably the chloride plate, the active material made into small blocks has been placed in the mold and the lead grid cast around it. Finally in the latest type of pasted plate two grids, each having a perforated sheet of lead cast on one side are riveted together with the sheet of lead on the outside, thus forming a number of completely enclosed pockets which hold the active material (Fig. 9).

Quite soon after the storage battery came into extensive use it began to be found that in spite of all possible precautions in the design of the grids, the peroxide of lead on the positive plates would always become soft on the surface and would gradually wash away, leaving the empty grid with little or no capacity. This inherent defect of the pasted positive led manufacturers to seek a remedy in the older or Planté type for their positives, and in this they were so successful that except for small batteries for automobiles and some few other cases

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where lightness is a great factor, the Planté type of positive is now always used. Its advantages consist in the facts that, (1) the peroxide being a very thin layer and very close grained, and also being protected from the wash of the electrolyte by reason of its location in the grooves or interstices of the plate, is not readily

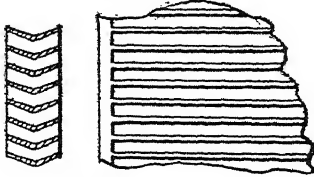


Fig. 7.—Winkler.

washed away as is the material of a pasted plate; and (2) that as the peroxide becomes very gradually disintegrated through use its place is continually filled by the fresh peroxide slowly "formed" by the working of the cell upon the surface of the main grid. The pure Planté plate made by casting a grid with very fine channels extending from one side to the other (Fig. 10), is the standard on the continent of

rugations being put on by a pair of toothed rolls.

The Planté plates consisting entirely of soft lead, are made by several different processes; by sawing the slots on both sides; by working into the surface a number of steel disks which cut into and squeeze out the metal between them, but do not remove any; by working over the surface with a sharp tool which takes a series of cuts, each time turning up a shaving at right angles to the surface but not detaching it; by rolling the lead between suitable corrugated rolls; and lastly by casting. The casting process is by far the best of all these, since it is the only one by which the plate can be made with stiffening ribs around the edges or wherever else desired. The product of all these processes is a flat plate from one quarter to a half inch in thickness, composed of a number of thin leaves lying in planes at right angles to the plane of the plate and spaced between 15 and 35 per inch, exposing to the acid a surface from five to ten times that of a plain plate of the same outside dimensions.

As the positive plates made after Planté's method came into increasing demand, manufacturers found that the process of forma-

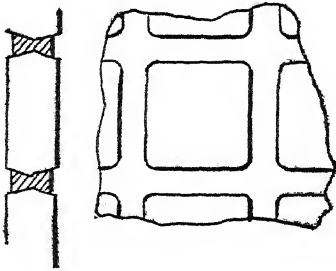


Fig. 8.—Chloride.

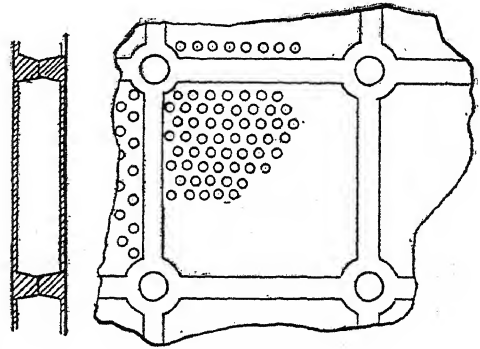


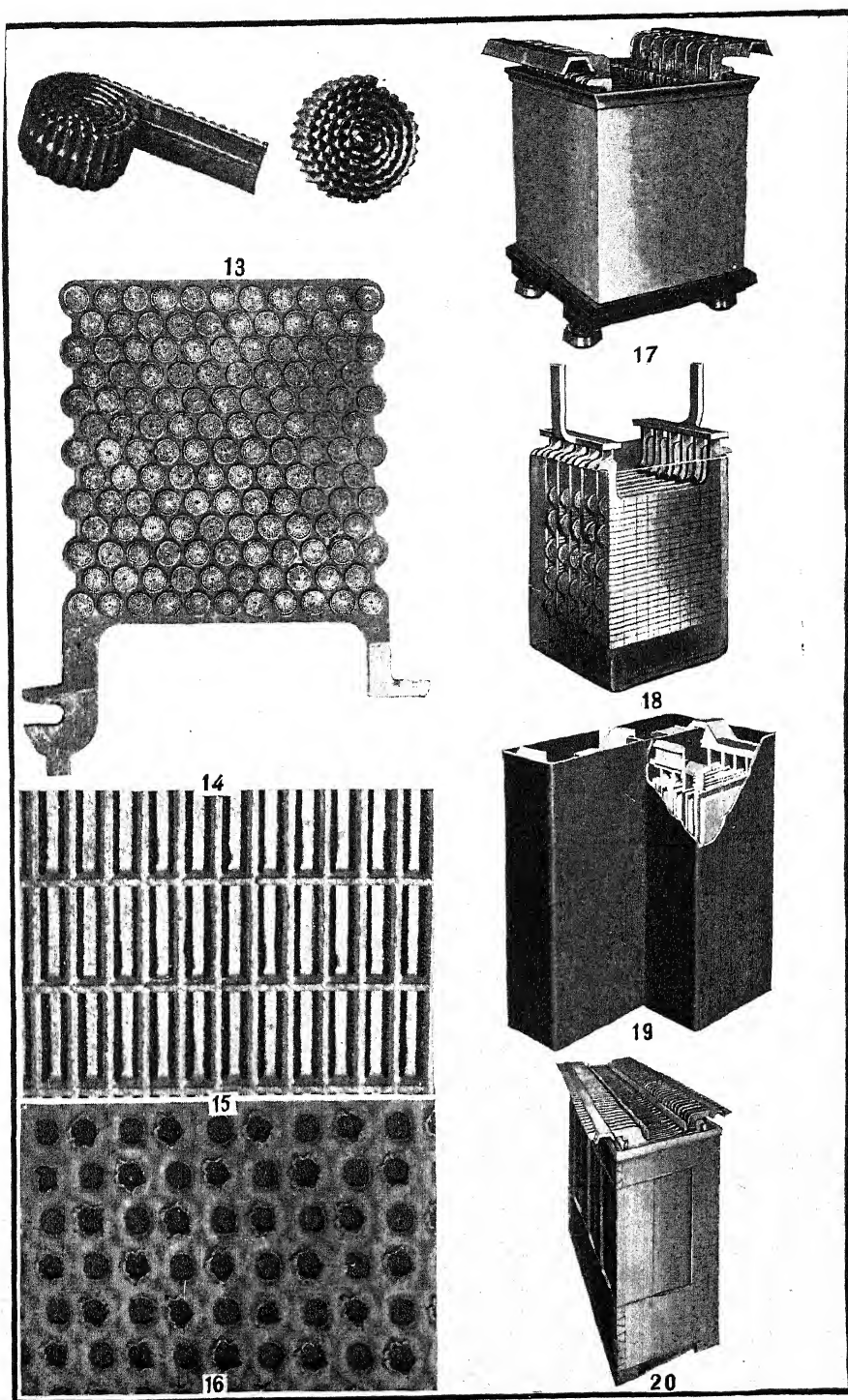
Fig. 9.—Box.

Europe, it having but the one fault, liability to become bent or "buckled" with use, to the extreme detriment of the battery.

In America, however, the type known as the "Manchester" positive has been the most successful. This plate with its prototypes is here illustrated (Figs. 11 to 14), and its distinctive feature is the combination of a stiff alloy grid with pure lead spirals or buttons, which furnish the active material. Since the peroxide of lead is "formed" by an electro-chemical process from the pure lead buttons, this plate is distinctly of the Planté type, but having the great advantage that it is very stiff and practically free from buckling, and its consequent evils, which are so common with the soft lead type. The grid for the Manchester plate is a casting of lead-antimony alloy, having a number of holes three quarters of an inch in diameter, placed as close together as possible and extending all the way through. Into each hole is forced a "button" of pure lead which offers a large surface to the acid; each lead button is made by coiling up a piece of transversely corrugated lead strip or ribbon, made by forcing solid lead under pressure through a suitable slot or die; the cor-

tion was exceedingly slow and expensive and hence they set to work to try to cheapen it. To this end they subjected the plates to be formed to the action of some chemical which would easily attack the surface and leave there a porous layer of a lead salt which could readily be "formed" into peroxide by the oxidizing agency of an electric current. Swan thus exposed his plates to the action of acetic and carbonic acid fumes, and thus covered his surfaces with white lead, while Dujardin dipped his plates into nitric acid and thus formed a layer of lead nitrate; the plates covered with a layer by either of these processes were set up in dilute sulphuric acid and there subjected to the action of a current which converted the porous layer into peroxide. It was soon discovered after this, that these two operations could be carried out together, and that it was thus possible, by adding a suitable amount of nitric acid to the sulphuric acid electrolyte, to form lead nitrate on the surface of the plate and simultaneously by the passage of a continuous current to oxidize the nitrate to lead peroxide. It is now known that the addition of almost any solvent of lead to a sulphuric acid electrolyte will very

# ELECTRIC STORAGE BATTERY.



For explanation of figures, see article.





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greatly facilitate the forming of plates therein, so that the process which took Planté several months is now done in as many days, nitric acid being the solvent most commonly used.

It has been stated above that the Faure, or pasted type of positive plate, is now used only for automobile work, where lightness is a primary factor, and as illustration of a plate of this kind, the so-called "exide" may be cited (Fig. 15). The grid, as will be seen, consists of a number of small lead alloy bars running parallel, and placed at the two surfaces of the plate in such manner that a bar on one side comes opposite to a blank space on the other. The active material inside the bars is held in so tightly that it can work out only as it disintegrates into very fine particles, as is normally incident to its use; and moreover, the wash of the electrolyte in the cell is much lessened by the lead bars on the surface of the plate.

The life of any plate of this kind is not so long as that of the Planté plate, but its capacity for the same weight is considerably higher, so that for the class of work mentioned it fills a very important place.

In the early days of storage batteries both Planté and Faure used positive and negative plates of identical construction, and any form of positive described above may be used as a negative; but the conditions under which the two plates operate are so different that it is now almost universal to use a special design for each. The main difference is that the metallic sponge lead constituting the negative active

tween them, and the whole group was immersed in the sulphuric acid electrolyte contained in a suitable glass vessel. But this form of cell was soon found very difficult to operate, since the felt gave no security against the plates becoming short-circuited, and it was frequently necessary to remove the whole element from the jar, unroll it, and substitute fresh felt, a matter of great inconvenience. To obviate this defect it has ever since been the practice to use plain flat plates anywhere between one eighth and one half inch in thickness, which either hang from the top or rest on the bottom of the jar, with a small space—one eighth to a half inch—between their adjacent surfaces. The plates are maintained in their proper position by the "separators"; either a pair of glass tubes or hard-rubber strips between each pair of plates, or else a thin sheet of insulating material such as perforated hard rubber. Formerly the glass tubes were most frequently used in large cells, and the perforated rubber sheets in small ones, but a recent development is the use of thin wooden diaphragms between the plates, which possess the great advantage that the particles of lead peroxide which are always present in the electrolyte, can never deposit between the plates

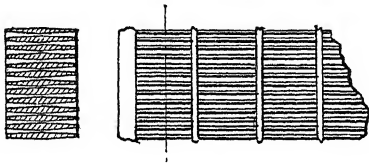


FIG. 10.—Tudor Positive.

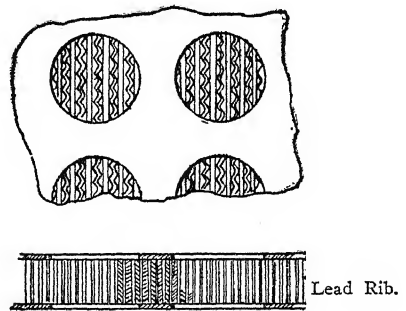


FIG. 11.—De Kabath.

material is quite a tenacious substance compared to lead peroxide, and consequently it does not yield to the wash of the electrolyte, and only in cases of the most flagrant abuse does it ever become softened so as to drop off from the grid. Under these circumstances, many of the grids (Figs. 1 to 9) which are quite inadequate to retain the lead peroxide of a positive plate are quite capable of making good negatives, and are in fact so used. The two forms of exide grid (Figs. 15 and 16) are among the best for small light batteries, while the box grid (Fig. 9) is the most largely used for central station work. This plate is made in two halves riveted together and completely surrounding the active material, the acid having access by means of a large number of small holes through the sheet which covers the sides. Under ordinary circumstances it is impossible for the sponge lead to work out of these perforations, so that the life of this type is much greater than that of any other heretofore developed.

Both Planté and Faure in their earlier experiments assembled their batteries by rolling up together in the form of a wide spiral the two sheets of lead which were to serve as positive and negative plates. The two sheets were insulated by means of pieces of felt rolled be-

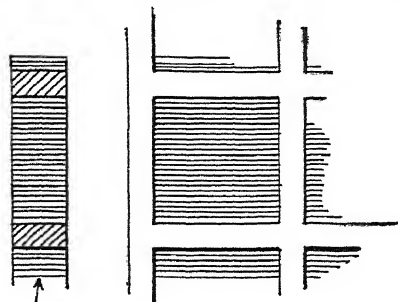
so as to bridge across and short-circuit them, as often happens with the older types.

The alternate plates in a cell are electrically connected together, the two sets thus resulting constituting the two poles, and considerable care is necessary in order that all the connections may be permanent; the only satisfactory way is to use lead throughout, and to melt or "burn" together the joints with an oxyhydrogen flame. There is then nothing that the acid can corrode and no cracks into which it can work its way so as to spoil a contact. The vessels used for retaining the electrolyte are principally of four kinds, according to the use they are to be put to; hard rubber jars for vehicle and other portable batteries; glass jars for small stationary plants; hard sheet-lead tanks, or lead-lined wooden boxes for medium and large station plants. The plates in the rubber jars rest upon ribs at the bottom; those in glass rest upon the edges of the jars; while in the large alloy and lead-lined tanks they rest or hang by suitable hooks or "lugs" upon glass plates which fit into the end of the cell and stand upon the bottom. (See Figs. 17, 18, 19 and 20.)

Thus far the theoretical side of the storage battery has not been considered, it will therefore be briefly discussed here.

## ELECTRIC STORAGE BATTERY

As has been already mentioned, when a battery is fully charged the active material on the positive plates consists of lead peroxide  $\text{PbO}_2$ , while that on the negative is porous metallic lead. Knowing that a current passing through weak sulphuric acid liberates oxygen at the pole where it enters the liquid and hydrogen where it leaves, the early investigators supposed that on discharge the oxygen generated at the negative by the discharging current combined with the metallic lead there to produce lead monoxide, while the hydrogen generated at the positive combined with the lead peroxide to form monoxide and water. On charging the cell the reverse process was supposed to occur; namely,

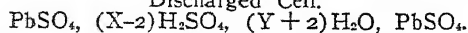
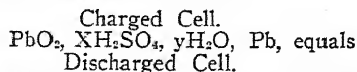


Alternate  
Lead and  
Asbestos  
Ribbons.

FIG. 12.—C. Smith.

the lead monoxide on the positive plate became converted by the oxygen there liberated into peroxide, while that at the negative was reduced by the hydrogen liberated to the state of metallic lead.

But later investigators, notably Gladstone and Tribe, noticed that the density of the sulphuric acid electrolyte always changed when a cell was either charged or discharged, rising on the former and dropping in the latter case. The amount of this change in density which they noticed was much greater than could be accounted for by the old theory, and hence they were led to examine into the chemical composition of the active material at various stages of charge and discharge. Doing this they found that both plates on discharge instead of being converted into lead monoxide were changed to lead sulphate, and hence the drop in density of the acid. Putting these reactions into the form of a chemical equation, we have:



That this reaction represents approximately the changes taking place in the storage cell is now generally acknowledged, but one thing which the equation does not account for is the fact that it is never possible to obtain anything like the full theoretical capacity from a cell. That is, experience has shown that after one half—at the utmost—of the active material has been turned to sulphate, the e.m.f. of the cell has dropped to zero and we can get no further current from it. The exact reason for this is not easy to give with certainty, but it is generally supposed that as lead sulphate is a very poor conductor it is necessary that a con-

siderable amount of lead peroxide and metallic lead respectively be left in the two plates in order that the active material as a whole shall be a conductor.

If the thermo-chemical equivalents of the above equation be considered it is found that a thermal change of 85,700 to 87,700 heat units is involved; and the temperature coefficient of a storage cell is .022 per cent per degree Fahrenheit. The well known equation of Helmholtz,

$$E = \frac{U}{23073} + T \frac{de}{dt}$$

(where E is the voltage of the cell, U the heat energy of the chemical reactions involved, T the

absolute temperature, and  $\frac{de}{dt}$  the temperature

coefficient), gives from these values 1.96-2.01 volt as the e.m.f. of a storage cell at 63° Fahrenheit; while the observed e.m.f. is 1.99-2.01, an agreement which greatly strengthens the theory. Applying to storage batteries the osmotic theory of Nernst, the German investigators Liebenow and Dolezalek conclude that the energy of the discharge is derived from the tendency of the ions of lead peroxide and of metallic lead to go into solution, and surprising as it seems at first sight this view appears to be gaining ground. At various times a great deal of most interesting work has been done upon the theory of storage batteries, yet it must be admitted that the theoretical development is far behind the practical up to the present time, and it is safe to say that, as in the case of most useful inventions, if the pioneers in the art had waited for a full theoretical knowledge the invention would never have been made.

**Properties.**—The fundamental property of a storage cell is its capability of storing energy, as the name implies. As has been pointed out, the source of the current of the battery is chiefly chemical energy. On the discharge of the cell this is converted directly into electrical energy, whereas on the charge the original chemical constituents are reproduced, with a consequent absorption of energy. The useful energy given out by the cell during discharge is of course never quite equal to that put in during the charge; both the quantity of electricity and its P.D. (that is, the difference of potential between the terminals of the cell) being smaller than in the former case. When a cell is discharging at constant current, its P.D. continually falls off until it reaches zero, the drop being very much more rapid as the end approaches. These phenomena are very much more easily understood by reference to the accompanying illustration (Fig. 21), in which the abscissæ represent time in hours and the ordinates show the P.D. between the terminals. The cell has not been completely discharged until the P.D. reaches zero, but since the latter end of the discharge would be of very little value, and beside this it is found very injurious to the cell to completely exhaust it, the usual practice is to stop the discharge when the voltage reaches some definite value, usually 1.8 for the normal rate, 1.7 for the hour rate, and the "capacity" is the number of ampere hours given out to this point. Similarly, when a cell is charged with constant current the P.D. gradually rises as illustrated in

## ELECTRIC STORAGE BATTERY

the upper curve (Fig. 21), but here it will be noticed that there is quite a definite point when the charge is completed, namely when the P.D. reaches a maximum value, as at the point

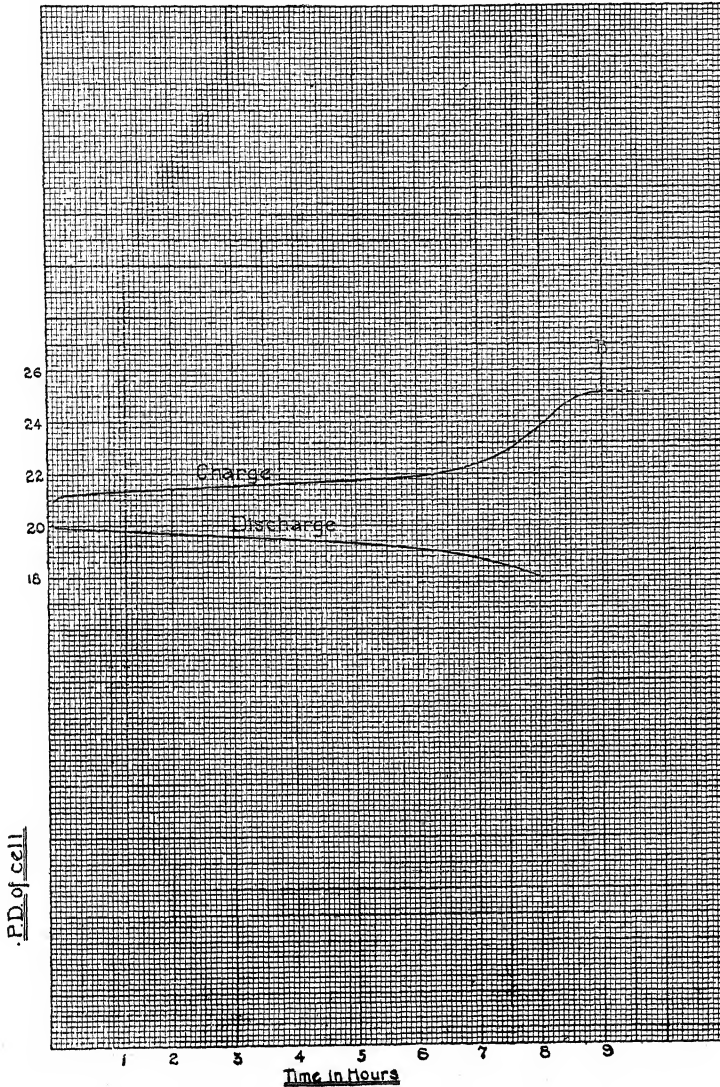
the temperature, and at constant temperature inversely with the rate of discharge. Within the ordinary range of working temperatures the capacity varies very nearly 1 per cent for every two degrees above or below 70° Fahrenheit.

Inasmuch as the energy of the cell is derived from the chemical substances which compose it, it would seem that the energy obtainable at a given temperature would be quite independent of the rate of discharge; such, however, is not the case, for when a high discharge rate is used the active material at the surface of the plate becomes quickly sulphated and forms a partial shield which prevents the acid from acting upon the material throughout the mass of the plate. On this account all types of lead storage battery give considerably less capacity at high rates of discharge than at low, but the amount of variation depends largely upon the construction of the cell.

Secondly, from the chemical equation of the discharge of the battery it follows that the amount of sulphuric acid available puts a limitation upon the capacity of the plates, and hence if the amount of acid in the cell be very small, so that at even high rates it is all used up, the capacity can be no higher at a low rate. This condition is never fully realized in practice, but in small cells for automobile use, where everything is cut down to the lowest weight, the amount of acid is very small and the capacity consequently varies but little with rate. In the case of a cell with a large excess

of acid the capacity varies nearly inversely as the square root of the rate of discharge, whereas in the case of automobile batteries it is much more nearly constant, being sometimes as low as the fifth root of the current; both these rules holding only within the ordinary range of currents. The variation of capacity with the rate is also somewhat dependent upon the type of plate used, since with very thin or very porous plates the acid is able to attack all parts of the active material more readily than with a thick or very compact one; but the effect of different kinds of plates upon this phenomenon is not so marked as might be expected.

In stating the capacity of a battery it is thus necessary to specify the rate at which it is to discharge, and the rate ordinarily assumed is



marked "B"; this point "B" shows that the plates have absorbed as much oxygen and hydrogen as they can hold, and if the cell be examined at this time these gases are found to be liberated in large quantities, causing a boiling or "gassing" that is very characteristic of the charged cell.

The capacity of the cell, that is the number of ampere hours it can give out on discharge is generally the measure of its useful size, and is the chief property by which it is bought and sold. A consideration of some of the most important points bearing on capacity is therefore of the highest importance. Firstly, the capacity of an individual cell is by no means constant, as might at first thought be assumed. The capacity at any given rate of discharge varies directly as

## ELECTRIC STORAGE BATTERY

that which a battery of stationary type can maintain for eight hours ; or for three or four hours if of the vehicle type.

In the lightest types of vehicle batteries it is found possible to obtain about 15 ampere hours per pound of active material, or 26 per cent of the theoretical capacity, but when the lead grids, acid, jar, connecting straps, and other accessories are included beside the active material, it is found that practically the best attainable for commercial conditions is five to six ampere hours per pound total weight of cell ; while in the large station types about one third this figure is attained.

A few words with particular regard to the electrolyte may be in place here. The two main functions of the electrolyte are first as a conductor of the current from one plate to the other, and secondly to furnish sulphuric acid, which shall enter into combination with the active material of the two plates on discharge. So far as the first function is concerned it would be preferable to use sulphuric acid solution of about 1.25 specific gravity, since that density gives the greatest conductivity. So far as regards the second function, the greater the density of the acid the better, since this would mean that a smaller total weight of electrolyte would furnish the necessary amount of acid for the discharge of the plates. But, unfortunately, there is a third consideration which must be given due weight, and that is the physical effect of the acid upon the plates. It is found that as acid above 1.2 specific gravity is used it begins to have an injurious effect upon the plates, whereas if under 1.15 it fails to carry out properly the second function, and in consequence the full capacity of the plates is not available. For ordinary usage, therefore, the electrolyte is used which shall be about 1.2 specific gravity in the charged condition of the cell, and in such amount that on discharge of the cell it will drop to about 1.15. In the automobile cells, however, it is usual to use acid that is somewhat heavier than this—as high as 1.250° to 1.300°—in order that a smaller amount of it may suffice to furnish the necessary lead sulphate on discharge ; the slightly less endurance of the plates being more than made up for the smaller total weight of the cell.

The mean P.D. of a battery on discharge may be taken at 1.9 volts, so that the maximum energy capacity is—for the vehicle type—about 10 to 12 watt hours per pound ; or, in other words, if all the energy of the cell could be expended in lifting the latter it would raise it 26,600 to 31,900 feet high. The magnitude of this figure is perhaps better realized by noting that it is about 100 times as great as the amount of energy which can be stored in a pound of elastic rubber, and 1,700 times as great as the amount that can be stored in a pound of steel wire having an elastic limit of 60,000 pounds per square inch.

The next important property of a battery is commonly its efficiency, and this is one of the determination of which requires considerable care. Two curves of charge and discharge (Fig. 21) are sufficient to give the efficiency, but a chance for error lies in the fact that it is difficult to tell whether both of these curves will represent the performance of the battery for a continued period. It is found always necessary to charge for a greater number of ampere hours

than are taken out on discharge, and the only way to tell how much this "overcharge" must be is to run a battery continuously for some time and carefully measure each charge and discharge. By carrying this out it is found that from 5 to 10 per cent more must be put in, in order to keep the battery in a properly charged condition, than is taken out. Furthermore, as these same curves illustrate, the mean voltage on charge is considerably higher than on discharge, and here is another source of loss. Taking the battery working at its eight hour or normal rate, the mean charge voltage will approximate 2.21, the mean discharge 1.91 ; summarizing, then, the voltage efficiency is  $86\frac{1}{2}$  per cent, the ampere hour efficiency is  $92\frac{1}{2}$  per cent, and the watt hour efficiency 80 per cent.

This last figure, the energy efficiency, is that which may be commonly obtained from a battery continually worked to its full normal rate capacity. A battery on the other hand, performing "regulating" work, that is, the steadying of a load which is subject to very large fluctuations of short duration, is called upon to alternately discharge and charge at rates as high as four to eight times the normal, lasting, however, for fractions of a minute only. Working at this service it is usual to give an overcharge once in several days, or once a week, and in the interval the battery is working at an ampere hour efficiency of almost unity, since the plates, being always only partly charged can always take up all of the charging current without the development of any gas. The periodic overcharge reduces the mean efficiency somewhat, so that 94 to 96 per cent is usually obtained in this kind of service. The voltage efficiency in this case is not materially different from that already considered, for while on the one hand the loss due to internal resistance is higher, on the other hand the successive cycles of charge and discharge follow each other so closely that the P.D. has not time to reach its ultimate value before the current is reversed and another value sought. The mean voltage which a battery maintains under these conditions, commonly called its "floating point," lies between 2.05 and 2.1 per cell ; and the shorter the intervals of charge and discharge and the lower the current the less is the departure from this mean value, while long intervals and higher currents cause the voltage to fall more on discharge and rise more on charge. With intervals such as commonly occur of from a quarter of a minute to a minute duration, and with current rates of four times the normal, the variation may be taken as 5 to 8 per cent on both sides of the floating point, and the watt hour (or energy) efficiency will then approximate 90 per cent.

To summarize the whole question, the efficiency of a storage battery in practical operation is usually between 75 and 90 per cent, the former figure applying where current rates are high and the battery plates large, and where full capacity is used, the latter where, though the current may be high, the duration of each discharge is very brief ; and the efficiency attainable in any given case is also somewhat dependent upon the temperature, type, and general condition of the battery.

The resistance is frequently an important consideration in the operation of a large battery plant, and it is the remarkably low value of this quantity which makes it possible to draw from

## ELECTRIC STORM — ELECTRIC TORPEDO

a storage cell a very much heavier current than from a primary cell of similar dimensions. Depending upon the size and type of plates, the separation, and the condition of a cell as to whether charged or discharged, the resistance varies between .03 and .08 ohms, divided by the normal or eight hour rate of the battery in amperes, the lower value holding nearly constant throughout most of the discharge followed by a rapid rise near the end. The resistance here referred to may be called the virtual resistance, being obtained from two readings of the cell voltage, first with current flowing and second on open circuit, and the difference between these two readings, termed the "drop," divided by the current, gives the virtual resistance. This virtual resistance is composed of two main factors, the resistance proper of the electrolyte, the plates, connections, etc., and a certain polarization resistance at the surface of the plates, and the accurate measurement of each of these factors separately is a matter of so much difficulty that it is seldom attempted.

*Storage Batteries Other Than Lead.*—Thus far there has been considered but one genus of storage battery; namely, that using lead or lead compounds as the active material, and dilute sulphuric acid as the electrolyte. To the present time no storage cell using other constituents than these has come into any extensive use, but there are three other classes which deserve to be noticed. The first class, the zinc-lead cell, may be regarded as a cross between the ordinary primary cell and the lead storage cell, since in the matter of a negative it follows the former class, and in the matter of a positive the latter, while the electrolyte is sulphuric acid, used sometimes with the primary, always with the lead storage battery. Upon discharge the zinc constituting the negative is dissolved to form zinc sulphate, while the lead peroxide on the positive is reduced and converted into sulphate. Since it is always troublesome to continually dissolve and re-deposit the material of a plate without destroying its original shape, a plan frequently adopted in this class of battery is to deposit the zinc upon a thin pool of mercury in the bottom of the jar, which keeps it always fully amalgamated and tends to prevent its dissolving by local action. This expedient, however, necessitates an awkward construction of cell, with very high resistance, and it is found in practice to have a very low efficiency beside, though it has the advantage of giving a very high P.D. of between 2 and 2.25 volts. This class of cell is applicable only where low currents are used and where weight is not a great factor.

The second class of storage battery, other than lead, is known as the copper-zinc, and its chief distinction from those heretofore considered is the use of an aqueous solution of caustic potash as electrolyte. The negative, as in the last class, consists of metallic zinc which dissolves on discharge, but the positive is composed of cuprous oxide, which on discharge simply becomes reduced to the metallic state. This class possesses the disadvantage of the first class, that it is very troublesome to dissolve and re-deposit the zinc continually without its becoming very lumpy and uneven, and moreover the cupric oxide which may be formed on overcharge is slightly soluble and may thus cause a great deal of trouble. A further drawback incident to

this class is its exceedingly low P.D. of only .8 volt.

The third class holds much the same relation to the copper-zinc as the lead cell holds to the lead-zinc, for it uses caustic potash solution as electrolyte, but replaces the soluble zinc negative by a grid pasted with an insoluble metallic sponge. Upon discharge, the metallic sponge becomes oxidized, while the metallic oxide on the positive becomes reduced, and on charge the original condition is reproduced. A great many experiments have been made, notably by Edison in this country and Jungner in Sweden, to determine the best active materials to use in this class of battery, but so far apparently without any very definite result. For the negative, iron and cadmium have been somewhat successful, while for the positive, nickel, cobalt, copper and silver have been recommended. The chemical reactions taking place in a cell of this class are approximately represented as follows:

Charged Cell. Discharged Cell.  
 $\text{Fe KOH H}_2\text{O Ni}_2\text{O}_3 = \text{FeO KOH H}_2\text{O Ni}_2\text{O}_2$

It will be noticed that this reaction is very simple and direct as compared with the reactions of any of the other classes of storage batteries, since the electrolyte maintains its composition unchanged and acts simply as a means of transporting oxygen from one plate to the other. The energy of the discharge is derived solely from the greater affinity of iron than nickel for oxygen, and consequently this class is often called the "oxygen lift" battery. The advantages claimed for this class of battery are greater capacity per unit weight, and longer life, against which must be counted the low P.D. of only 1 to 1.25 volts; and up to the present time the claims have not been commercially demonstrated, so the ultimate success of the class yet remains to be determined.

The lead storage cell on the other hand, in spite of some inherent faults, possesses such well established valuable qualities that it is constantly proving itself a commercial necessity, and is now recognized both in this country and in Europe as a standard piece of electrical equipment, in just the same light as are boilers, engines, and dynamos. See BATTERY; DYNAMO; ELECTRICITY.

HERBERT LLOYD, F. C. S.

*President The Electric Storage Battery Co.*

**Electric Storm.** See ELECTRICITY, ATMOSPHERIC; LIGHTNING.

**Electric Stress,** the force that causes the deformation of the surface of a substance within an electric field.

**Electric Sunstroke,** an effect similar to sunstroke, sometimes experienced by persons exposed for a long time to intense electric light.

**Electric Telegraph.** See TELEGRAPH.

**Electric Telegraph Cable.** See CABLE; TELEGRAPH.

**Electric Telephone.** See TELEPHONE.

**Electric Tension.** See BATTERY; ELECTRICITY; ELECTRO-MOTIVE FORCE.

**Electric Torpedo,** a torpedo operated by electricity. There are various kinds of electric torpedoes. The Sims-Edison torpedo is driven by an electric motor, and its motions are controlled from the shore by electricity. The torpedo proper is carried some distance below the surface of the water by a vessel immediately



## ELECTRIC TRANSMISSION—ELECTRIC VEGETABLE GARDENING

above it, from which it is suspended by two rigid bars. In the torpedo is a cable reel on which the conducting cable is disposed. An electric motor and controlling gear are also contained within the torpedo. In its front the explosive is placed. It is driven by a screw propeller actuated by the electric motor. As it moves it pays out cable so that it has no cable to draw after it through the water, the cable lying stationary in the water behind it. This avoids frictional resistance to its motion. The maintenance of the torpedo at a proper depth is one of the advantages of the system over other methods.

**Electric Transmission of Energy,** the transmission of motive power by means of an electric current. Recently there has been a tendency on the part of electrical engineers to turn their attention to the problem of utilizing heads of water for the purpose of generating electric energy to be used in furnishing light and power, not only to the towns near which they are situated, but by electric transmission to towns at a distance. At the beginning of 1903 there were 485 of these electric power plants in the United States, the most important of them being that of the Niagara Falls Power Company, at Niagara Falls, N. Y., which on 17 Nov. 1896, sent 1,000 horsepower of electric energy from Niagara Falls to Buffalo, N. Y., a distance of 26 miles, where it was successfully utilized in propelling the street cars of the Buffalo Railway Company. This transmission scheme is still in successful operation; its capacity is being gradually increased, and will continue to be until it is capable of transmitting 20,000 horsepower of electric energy. During the electrical exhibition held in New York in May 1896, about one thirtieth of a horsepower was transmitted from Niagara Falls to the exposition building, a distance of 453 miles, where it was successfully used to operate a working model of the Niagara Falls Power Company's plant. This is the longest electric transmission of energy ever attempted.

**Electric Vapor Lamp,** a recent invention known as the Cooper-Hewitt mercury vapor lamp; said to be the most original and important discovery in relation to general distribution of electric current for light and power purposes that has been brought to public attention since the advent of the commercial use of electricity. This remarkable device, in the shape of a small globe less than one foot in diameter, converts alternating to direct current, and the claim is made that by reason of its simplicity, cheapness, great efficiency and absence of moving parts, will eventually displace the large and costly apparatus now used everywhere. See VAPOR LAMP, THE HEWITT MERCURY.

**Electric Vegetable Gardening.** Experiments carried on at the government agricultural station at Amherst, Mass., since 1900, show that the use of electricity by the farmer is a distinct and valuable stimulus to nature and exerts a marked influence upon the germination of seeds and the growth of farm products. Scientists argue that roaming around loose in the atmosphere there is a vast fund of electrical force, which by means of specially devised apparatus, can be attracted to the earth and distributed through the ground where the gardener has sown his seeds. The apparatus by means of

which the electricity is caught and harnessed has been tested at Amherst and has proved to be a complete success. Briefly described it consists of a number of copper spikes which are elevated at the top of a 50-foot metallic pole. These spikes gather the electric fluid from the atmosphere and convey it to the foot of the pole, where it is caught by wires buried a few feet beneath the ground and distributed over as large a section as the gardener desires. Each of the poles will gather and distribute enough electricity to cover several acres of ground. With this apparatus experiments have been made which may be summarized as follows: After seeds have been subjected to the electric treatment for a period of 24 hours, it was found that over 30 per cent more seeds were germinated by the aid of electricity than in a like quantity of seeds sown in ground that lacked the electrical stimulant. As the scientists in charge of the experiments wished to make a very complete test, the electric current was applied to seeds that were allowed to stay in the ground for 48 hours. In this case it was found that 20 per cent more seeds had germinated in the electrified ground than in the soil where the seeds had been left to sprout under normal conditions, and in 72 hours this percentage had dropped to 6, thus showing that the use of the current for the purpose of stimulating germination under all the tests was a decided success.

In the various tests seeds subjected to only a temporary current of electricity have been found to show the effect for a few hours and then resume their normal growth. In one instance to produce a constantly beneficial effect it was necessary to apply the electricity every hour to germinate growing plants or seeds. In order to obtain a specific illustration of the effect of electricity, 100 seeds of the horse-bean were sown in moist sawdust, 24 of the seeds having been previously selected as seeming to nearest resemble each other. On the radicle of each of these was placed a dot of indelible ink one centimetre from the tip. The beans were sown and received hourly stimulation, lasting about 30 seconds, for a period of 48 hours. The growing plants were carefully measured, the dot of ink being the constant point from which their increase could be determined. It was found at the end of 12 hours that the gain per cent by the use of the electric current was 19.11; at the end of 24 hours the gain per cent was 44.95; at the end of 36 hours the gain was 42.13 and at the end of 48 hours 39.47. Repeated experiments on the same line produced almost precisely the same results.

Another interesting experiment made in 1902, was planting in two sections of ground, the soil in both of which had been carefully selected to ensure it being exactly alike, seeds of the following varieties: parsnip, lettuce, carrot, turnip, radish, and onion. To one of the sections of ground a mild current of electricity was applied. The following day the plants in the electrified plot began to appear, the turnips sprouting first. The rapidity of growth of those planted in the electrically treated ground was far in advance of those treated in the ordinary ground. The second day plants broke through the surface in both plots, those in the electric garden showing considerably the more rapid growth; the foliage was rank, and when harvested was nearly twice as high as that of the non-electric plot. The



## ELECTRIC VOLTAIC BATTERIES—ELECTRO-CHEMICAL INDUSTRIES

roots also were larger and showed a marked difference in favor of electricity. One peculiarity was that in the electric plot for every pound of roots very nearly a pound of tops was produced, while in the other case for every pound of tops there grew 1.43 pounds of root, but the difference in the total was all in favor of electricity. With reference to the other vegetables, the lettuce proved a failure in both plots. The carrots showed a marked superiority in the electric bed over those in the non-electric. The onion plants came up in both beds and grew finely for a time, then blasted and not one developed, neither electric nor non-electric, this being the only case of all the vegetables where no tangible results were obtained. Next to the parsnips, the radishes gave the best results. They grew rapidly, those in the electric garden being always ahead. The tops were rank and the roots were crisp. When the best of the radishes in each plot were pulled, washed and weighed, it was found that the six largest roots taken from the electric plot weighed two ounces more than the six largest ones taken from the non-electric plot. They were larger individually, the tap root was longer, were of a finer flavor, of better quality, more brittle, and every way superior to those raised without the aid of electricity. The two largest radishes taken from the electric row weighed 14 ounces, while the two largest from the non-electric row weighed 10 ounces, or 4 ounces in favor of electricity.

Besides the electric treatment of the soil, experiments have been made with the electric light for stimulating the growth of plants, and the general effect has been to hasten the maturity of lettuce, spinach, and similar products. It has been found that the electric light has the stimulating effect of daylight upon the plants, and crops thus encouraged by light from arc lamps have showed 50 to 60 per cent increase. In short it has been clearly demonstrated that by means of electricity nature can be forced to do double duty without lessening the worth of her products.

**Electric Voltaic Batteries.** See BATTERY; ELECTRICITY; PRIMARY BATTERIES.

**Electric Waves.** See ELECTRICITY.

**Electric Welding,** the process of uniting together two pieces of metal, the necessary high temperature at the junction being obtained by the passage of a powerful electric current across it. The pieces of metal are placed end to end and subjected to some pressure. A very strong current is then sent along them, and as there is imperfect contact, and consequently a high resistance, at the junction, intense heat is developed there. The metals soon unite perfectly, and the junction is hammered into shape. In all cases the junctions must be perfectly clean, and different fluxes, depending on the nature of the metals, are used to prevent oxidation during the heating process. In the case of iron, borax is the flux usually employed. Since the currents employed for the purposes of welding are necessarily exceedingly powerful, it is found more economical to use for the purpose alternating currents which are passed through a transformer and emitted at a reduced pressure and an increased strength.

**Electric Wireless Telegraph.** See DEFORREST; MARCONI; TELEGRAPH; WIRELESS TELEGRAPH.

**Electric Wiring.** See ELECTRICITY; TELEGRAPH.

**Electrine,** (1) The principle of electricity; a kind of matter which manifests electrical phenomena. (2) Made of amber or electrum.

**Electrizer,** an apparatus for the application of electricity for medical purposes. See ELECTROTHERAPEUTICS.

**Electro-ballistic,** pertaining to projectiles and to electricity. An electro-ballistic apparatus is an instrument for determining by electricity the velocity of a projectile at any part of its flight. The projectile passes through a wire screen, thus breaking a current of electricity and setting in motion a pendulum which is arrested on the passage of the projectile through a second screen. The distance between the screens being known, the arc through which the pendulum vibrates measures the time due to the flight of the projectile between the screens. See GUNNERY.

**Electro-ballistic Machines.** See GUNNERY.

**Electro-biology,** the science which treats of the electric currents developed in living organisms; also the department of knowledge which treats of the influence or control over the feelings, thoughts, and actions of a mesmerized person.

**Electro-bronze.** See ELECTROPLATING.

**Electro-chemical Industries.** The word electro-chemical is here used to include electro-metallurgy, as there is no generic term for the two subjects. Electro-chemistry may be defined as that branch of science relating to the electrical production of chemical substances and chemical action, or to the generation of electrical energy by chemical action. On the other hand electro-metallurgy is the branch of science that relates to the electrical production and treatment of metals.

**Electrolytic Refining of Copper.**—The largest and most important of all electro-chemical industries is the refining of copper, which is conducted at many places in this country and abroad. The process of refining copper electrolytically consists in the transfer of copper from the anode to the cathode, by the selective action of the electric current, and in leaving the impurities behind in the anode, electrolyte, and in the slime or sediment.

The material at present subjected to profitable electrolytic refining is crude copper containing from 96 to 98 per cent pure copper, and varying amounts of silver, gold, nickel, iron, arsenic, antimony, sulphur, etc. This crude copper is obtained from various copper ores by smelting, and is cast in iron molds into anode plates, which are about 3 feet long, 2 feet wide, and 1 inch thick, weighing approximately 250 pounds. The cathode plates are of electrolytically refined copper, practically the same in length and width as the anodes but only 1-20 inch thick. The electrolyte, or bath, in which the plates are suspended is a solution of 12 to 20 per cent copper sulphate, and 4 to 10 per cent sulphuric acid, the latter being introduced to decrease the resistance of the bath which is kept at a temperature of about 40° C. The containing tanks are of wood, usually lined with sheet lead or carefully coated with a pitch compound, and of such dimensions that a distance of about 1 inch exists between the faces of the plates. In some

## ELECTRO-CHEMICAL INDUSTRIES

cases the plates are arranged in series, and in others in parallel or multiple, as illustrated. The former has the advantage of requiring electrical connections to be made at the first and last plates only, whereas the parallel system requires a connection at every plate; but in the series system the leakage of current due to the short-circuiting action of the sediment and sides of the tank is from 10 to 20 per cent, so that the parallel is more generally used. The connections between the various plates to the circuit in the parallel systems are made by copper rods, which are run at two different levels along the edges of the tanks, one bar for each set of plates. In some instances these rods are of the inverted V shape, so that the edges will cut through any corrosion which may happen to form at the points of contact. The vats are arranged with respect to each other, so that each is accessible from all sides, and the circulation of the electrolyte is possible. This circulation may be obtained by blowing a stream of air through the electrolyte, but more frequently by arranging the vats in steps, and piping so that the electrolyte may pass from the top of one vat to the bottom of the next, as shown in the illustration. This maintains a uniform density of electrolyte which is necessary for the proper formation of the deposit. The electrical pressure required is from .2 to .4 volts per tank, with a current density of 10 to 15 amperes per square foot of cathode plate surface. The individual vats are connected in series, so that the total voltage required may be approximately the same as that which the generator furnishes, being usually 110 volts. In practice from 400 to 500 ampere-hours are required per pound of copper deposited, the theoretical amount according to Faraday's law being only 386.2 ampere-hours. The loss varies from 4 to 20 per cent according to the system employed.

The cost of refining copper by the electrolytic method is from  $\frac{1}{4}$  to  $\frac{3}{4}$  cent per pound. The following products of refining are marketed: Commercial cathodes, which are sometimes shipped to consumers, but more frequently cast into wire bars, ingots, cakes, or slabs of standard dimensions and weight. They usually assay from 99.86 to 99.94 per cent pure copper. The yield in commercial cathodes is from 97 to 99 per cent of the anodes treated, excluding the anode scrap which varies in weight from 7 to 15 per cent of the original anode in parallel plants, but this scrap is not a loss as it is collected and recast into anode plates. Besides electrolytic copper, most plants secure gold, silver, and nickel salts in the slime, from which the metals are recovered. The electrolytic refineries in the world are now producing copper at the rate of 322,295 tons annually, valued at \$96,688,500, with copper selling at \$300 per ton, in addition the by-product in recovered gold and silver is valued at \$20,000,000 per annum. There are now in active operation 33 electrolytic refineries, with a total generator capacity of 20,000 kilowatts, 10 of these are in the United States, and supply about 86 per cent of the world's product; 6 plants are in England and Wales, producing about 9 per cent; while the remaining plants are on the continent of Europe.

**Aluminum.**—Practically the output of this metal for the entire world is now produced electrolytically. The only process used on a large scale is that invented independently in

1886 by Charles M. Hall in the United States and by Paul L. V. Héroult in France. This process consists in electrolyzing alumina dissolved in a fused bath of cryolite. The alumina is obtained from the mineral bauxite which occurs abundantly in Georgia, Alabama, and other regions. The natural material, being a hydrated alumina containing silicon, iron and titanium, must be treated in order to drive off the water and eliminate the impurities. Formerly this was accomplished by a chemical process, but now it is effected more simply and cheaply by heating the material mixed with a little carbon in an electric furnace. The impurities are thus reduced and collect as a metallic regulus in the bottom of the mass. This leaves the alumina nearly pure and it may be tapped off while fused or easily separated by breaking it up after cooling. In practice it requires two pounds of alumina for each pound of aluminum produced. The flux or bath in which the alumina is dissolved consists of cryolite, a natural double fluoride of aluminum and sodium ( $\text{Al}_2\text{F}_6\cdot 6\text{NaF}$ ) found in Greenland. This is melted in a large carbon-lined, sheet-iron tank which constitutes the negative electrode, a group of suspended carbon rods forming the positive electrode. A current of several thousand amperes at 6 to 7 volts is used. Only a portion of this voltage is required to decompose the alumina, the balance amounting to about 4 or 5 volts represents the heat produced which keeps the bath melted. The passage of the current causes the aluminum to deposit on the bottom of the tank as a fused metal, being drawn off periodically. The oxygen set free combines with the carbon of the positive electrodes and passes off as carbonic oxide. The reaction is  $\text{Al}_2\text{O}_3 + 3\text{C} = 2\text{Al} + 3\text{C O}$ . About one pound of carbon is consumed for one pound of aluminum produced. When the alumina becomes exhausted from the bath, the voltage rises and lights a lamp shunted across the electrodes, thus giving notice that more material is needed. Each electrical horsepower produces about one pound of aluminum per day of 24 hours. According to Faraday's law the weight of aluminum deposited by 1,000 amperes is .743 pound per hour. The actual yield of metal by the Hall process is about 85 per cent of this theoretical amount. The total power used by the various works employing the Hall process, is very large and amounts to more than 15,000 horsepower in the United States and Canada. The total power employed in European plants operating under the Héroult patents is nearly as great. The metal when drawn from the tanks is cast into rough ingots which are afterwards remelted and converted into commercial shapes, such as sheets, rods, wires, etc.

### *Electrolytic Production of Caustic Soda.*—

The production of caustic soda ( $\text{NaOH}$ ) and chlorine ( $\text{Cl}$ ) by the electrolysis of common salt ( $\text{NaCl}$ ) is readily realized experimentally ( $\text{NaCl} + \text{H}_2\text{O} = \text{NaOH} + \text{Cl} + \text{H}$ ), but its successful accomplishment on a commercial basis is difficult because of the secondary reactions which take place, forming a mixed product of caustic, salt, and hypochlorite of soda. These difficulties are avoided by separating the caustic soda or sodium that is formed, either by a porous diaphragm, by drawing it off as soon as formed, or by absorbing the sodium deposited in mercury or melted lead.

## ELECTRO-CHEMICAL INDUSTRIES

The two most successful systems for the electrolytic production of caustic soda and chlorine from common salt, are the Castner-Kellner and the Acker processes, one operating at moderate temperatures ( $40^{\circ}\text{C.}$ ) and the other at high temperatures ( $850^{\circ}\text{C.}$ ). The Castner process employed in this country at Niagara Falls is as follows: The electrolytic tank consists of a slate box, 4 feet long, 4 feet wide, and 6 inches deep, the joints being made by means of a rubber cement. Two slate partitions reaching within 1-16 inch of the bottom (under which are grooves) divide the cell into three compartments, each 15 inches by 4 feet, sealed from each other by a layer of mercury covering the bottom of the tank to a considerable depth. The outside chambers through which the brine is passed are provided with carbon anodes, shaped like a rail section, the broader flange being placed about half an inch above the mercury. These compartments are provided with tight covers and exhaust pipes of rubber and lead, to lead the chlorine away. The central compartment has an iron cathode, of 20 upright strips, and is supplied with pure water, which is drawn off whenever its specific gravity increases to 1.27 due to the presence of the manufactured caustic, while the liberated hydrogen is led from this chamber by means of pipes and used as a fuel for the concentration of the caustic. The tank is pivoted at one end on a knife blade and rests at the other on an eccentric, which raises and lowers that end of the tank about half an inch every minute and causes a circulation of the mercury between the outer and middle compartments. The current passes into the outer chambers, splits up the sodium chloride (common salt,  $\text{NaCl}$ ) into sodium and chlorine ( $\text{Na}$  and  $\text{Cl}$ ), the latter is liberated at the carbon anodes and passes through the exhaust pipe to the absorption chambers where it combines with slacked lime to form bleaching powder. The sodium combines with the mercury forming sodium amalgam, which by the tilting of the tank passes to the centre chamber, where it serves as the anode, and combines with the water to form caustic soda ( $\text{NaOH}$ ) and hydrogen ( $\text{H}$ ), which appears at the iron cathode. Each of these tanks uses 630 amperes at 4.3 volts. The theoretical voltage required is but 2.3, the remainder being utilized in overcoming the ohmic resistance of the electrolyte and in keeping it warm. The output of this process per horsepower per day is 12 pounds of caustic and 30 pounds of bleaching powder for each cell. The product of this process contains from 97 to 99 per cent caustic, 1 to 2 per cent sodium carbonate, .3 to .8 per cent of sodium chloride, and traces of sodium sulphate and silicate of sodium.

The Acker process, also used at Niagara, to obtain caustic soda and chlorine from salt, is similar to the Castner-Kellner process just described, but differs in that it employs molten lead in place of mercury as a seal, fused salt instead of brine as the electrolyte and operates at a temperature of  $850^{\circ}\text{C.}$  which is required to maintain the fused condition of the electrolyte. The containing tank is a cast iron vessel 5 feet long, 2 feet wide and 1 foot deep, the sides above the molten lead being covered with magnesia so that the current must pass from the carbon anodes to the lead which acts as the cathode. At one end of the tank is a small

compartment separated from the remainder of the vessel by a partition dipping into the lead to such a depth that nothing but this fused lead can pass from one compartment to the other. In the smaller compartment the lead is subjected to a stream of steam, which acting upon the lead sodium alloy forms caustic soda and liberates hydrogen. At various intervals the caustic, which is in a fused state, is drawn off and allowed to solidify, thus avoiding the evaporation of the water which is necessary in the Castner-Kellner process. The current employed per vessel in the Acker process is 2,100 amperes at from 6 to 7 volts, of which energy 54 per cent is used in chemical action, and the remainder in maintaining the temperature.

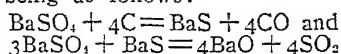
*Potassium Chlorate* is produced electrochemically in considerable quantities, both here and abroad. The Gibbs process, used at Niagara Falls, consists in the electrolysis of potassium chloride solution, using a copper or iron cathode and a platinum anode. The current density is high, being 500 amperes per square foot of anode. Each cell uses about 4 volts, of which 1.4 is required to convert chlorid to chlorate, and the remainder produces the heat that maintains the electrolyte at from  $50^{\circ}$  to  $70^{\circ}\text{C.}$ , which is necessary for the proper reaction.

*Electrolytic Chemical Effects*, such as bleaching, have been produced through the action of chlorine or other matter set free by an electric current. It is possible in this way to cause substances to act while in the nascent state, and therefore more powerful. Disinfecting and deodorizing of sewage has also been accomplished in a similar manner.

*Calcium Carbide*.—This compound is produced by the electrothermal process, invented by Willson in 1891, the total output throughout the world being about 300,000 tons in 1902. Its value lies in the fact that 1 pound of this substance mixed with water produces theoretically 5.5, and actually about 5 cubic feet of acetylene, equivalent in illuminating power to about 70 cubic feet of ordinary gas. The reaction producing acetylene is  $\text{CaC}_2 + \text{H}_2\text{O} = \text{CaO} + \text{C}_2\text{H}_2$ . Various forms of electric furnace have been employed in the production of calcium carbide. One type invented by King and represented in the illustration, consists of an iron car A, which holds the materials and carbide at the same time acting as one electrode. It can be run into place or removed as desired, and being provided with trunnions its contents may be tipped out. The other electrode consists of a bundle of carbon plates carried by a heavy rod C, composed of a copper strip strengthened by iron side bars. The material, which is fed through the channels G F, consists of a mixture of 1 ton of burnt lime and  $\frac{3}{4}$  ton of ground coke to produce 1 ton of carbide, the reaction being  $\text{CaO} + 3\text{C} = \text{CaC}_2 + \text{CO}$ . An arc is first formed between the electrode C and the floor of the truck. The resulting high temperature converts the mixture into carbide, the electrode being gradually raised and more material added until the car is nearly filled with the product, when it is run out and replaced by another. At Niagara Falls a rotary form of furnace invented by C. S. Bradley is used, being operated continuously and producing about 2 tons in 24 hours when supplied with 3,500 amperes at 110 volts, or about 500

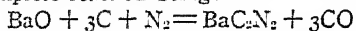
horsepower. Since no electrolytic action is required an alternating current is employed.

**Barium Compounds.**—The principal source of barium is barite or heavy spar, the natural sulphate. Processes for converting this material into barium hydrate, nitrate, chlorid and other soluble salts have been invented by C. S. Bradley and C. B. Jacobs. They consist in melting in an electric furnace a mixture of barium sulphate with a small quantity of carbon. If one part of carbon to 5 parts of sulphate be present, the sulphate would be all reduced to sulphid, but with one fourth as much carbon a corresponding amount of sulphid is produced which reacts upon the unchanged sulphate and the oxid is obtained, the two reactions being as follows:



The carbonic oxide (CO) and sulphurous acid (SO<sub>2</sub>) pass off as gases, the latter being used to make sulphuric acid. The fused barium oxide (BaO) is tapped off, cooled, broken up and then digested with hot water. On cooling, barium hydrate [Ba(OH)<sub>2</sub>·8H<sub>2</sub>O] crystallizes out. This is used in extraction of sugar, making of white paints, "softening" water, and producing other barium compounds.

**Cyanides of Potassium and Sodium** are produced electro-chemically by the process of C. S. Bradley, C. B. Jacobs and others. A mixture of barium oxide or carbonate is heated in an electric furnace to produce barium carbide (BaC<sub>2</sub>). While the mass is still hot, nitrogen gas is passed through it and barium cyanide is formed, the complete reaction being:



The barium cyanide thus produced is treated with sodium carbonate, the result being a mixture of sodium cyanide and barium carbonate. The former is separated by dissolving it in water, the insoluble barium carbonate being used over again. Potassium cyanide is made in a similar manner, and either salt is suitable for gold extraction and other purposes for which cyanides are employed.

**Carborundum** is a commercial name for carbon silicide, which is produced in large quantities according to the inventions of A. G. Acheson and his assistants. It is used as an abrasive, being hard enough to scratch ruby. It is formed by intensely heating in an electric furnace, a mixture of 3½ tons of ground coke, 6 tons of sand, and about 1½ tons of sawdust and salt, the yield being 3 or 4 tons of crystalline carborundum and about as much more of the amorphous material. The furnaces used at Niagara Falls consist of simple brick hearths 16 feet long and 6½ feet wide, with solid brick walls at each end, about 2 feet thick and 6 or 8 feet high as illustrated. In the middle of each of these walls there are iron frames through which the current is led to a core composed of carbon, weighing about 1,000 pounds, and extending the entire length of the furnace. This core is raised to a very high temperature by passing through it for 36 hours, an alternating current of about 1,000 electrical horsepower at 190 decreasing to 125 volts. The heat from the core permeates the mass and converts it into carbon silicide which is broken up after the furnace has cooled and used to make hones, wheels for grinding, etc.

**Artificial Graphite.**—As an outgrowth of the carborundum process, Mr. Acheson has developed on a large scale the manufacture of artificial graphite. The material ordinarily used is anthracite coal ground to about the size of rice, which is raised to an exceedingly high temperature in a long electric furnace in the form of a trough about 2 feet square and 30 feet in length. An alternating current of about 1,000 horsepower at 220 to 80 volts is passed for 20 hours longitudinally through the mass, which becomes converted into graphitic carbon. Another line of manufacture consists in graphitizing moulded articles of carbon, such as blocks and rods for electrodes, which are piled in a furnace similar to that described for converting coal into graphite. By using different materials and conditions the two methods produce different kinds of graphite suitable for lubrication, crucibles, pencils, stove polish, electrodes, etc.

**Electric Smelting.**—One of the earliest commercial processes in electro-chemistry was that devised by E. H. and A. H. Cowles in 1884. A mixture of about 2 parts of alumina, 1 or 2 parts of granulated copper and 1 or 2 parts of carbon was introduced in a brickwork chamber. Bundles of carbon rods inserted at the ends formed the electrodes between which a current of 3,000 amperes at 50 volts was maintained. At a very high temperature the alumina was reduced (Al<sub>2</sub>O<sub>3</sub> + 3C = Al<sub>2</sub> + 3CO) and the resulting aluminum combined with the copper to form aluminum bronze.

**Iron and Steel** can be produced by reducing iron ore with carbon in an electric furnace. For example, a mixture of magnetite and carbon can be heated by passing a current through it as in the Cowles aluminum bronze process, through a carbon core in contact with the material as in the carborundum process, or by the action of an arc as in the carbide process. The reaction is simply Fe<sub>3</sub>O<sub>4</sub> + 4C = 3Fe + 4CO. Pure (that is wrought) iron, cast iron or steel may be produced, depending upon the proportion of carbon. The chief advantages are the directness of the process, and the fact that the impurities in the fuel (sulphur, silicon, etc.) are not introduced. On the other hand it is a question whether the electric furnace can compete in economy with the blast furnace and Bessemer converter.

**Alundum**, the trade name for artificial corundum, is an abrasive made by a process due to C. B. Jacobs. Bauxite, a natural hydrated alumina, the same material as used in the Hall aluminum process, is calcined to drive off the water and then fused in an electric furnace using 80 volts and 2,000 amperes of alternating current. The mass is allowed to cool and then broken up, having a blue or red color and being of the nature of sapphire and ruby, in fact it is chemically identical with these gems. It makes excellent emery wheels, emery paper, etc.

**Nitrogen and Oxygen Compounds** are produced by the electrical process of C. S. Bradley, and D. R. Lovejoy. The apparatus consists of a cylindrical chamber through which a number of electrodes, E, E, are introduced as illustrated. The ends of the radial arms A, A carried by a revolving spindle S pass very close to the electrodes. A pressure of 6,000 to 8,000 volts maintained by the generator G, between the arms and the electrodes, produces arcs 4 to 6 inches long that are drawn

momentarily. The current is unidirectional, but being pulsating, an induction coil C in series with each electrode, cuts the current down to about .005 ampere per arc. There are 180 stationary electrodes in each chamber, and as the arms revolve 500 or more times per minute, at least 18,000 arcs are formed in each chamber in that time. Ordinary air, after being dried, is passed through the chamber, where the arcs cause a certain percentage of the nitrogen and oxygen to combine. This compound absorbed in caustic soda forms sodium nitrite or nitrate, with potassium hydrate it forms potassium nitrite or nitrate, and by absorption in water nitric acid may be produced.

Ozone is produced in chambers through which a silent electric discharge is caused to pass from a static electric machine, induction coil or very high voltage transformer. If air circulates through the chamber a certain portion of its oxygen is converted into ozone.

*Organic Compounds*, such as dyestuffs, vanillin, iodoform, chloroform, are also produced electrically. See ELECTRO-CHEMISTRY; ELECTRIC FURNACES; METALLURGY.

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**Electro-chemical Series**, the arrangement of a number of chemical substances in the order of their affinity for the positive or for the negative pole of a battery.

**Electro-chemical Society.** The American Electro-chemical Society was founded in Nov. 1901, at Philadelphia. The second general meeting was held at Niagara Falls during October 1902, and the third in New York in 1903. The society has now about 500 members. It was organized to promote the interests of theoretical and applied electro-chemistry and electro-metallurgy, and its influence has already been felt in that new and rapidly growing industry. Its membership includes most of the prominent electrical engineers and electro-chemists in this country.

**Electro-chemical Telegraph**, a telegraph which records signals upon paper imbued with a chemical solution, which is discharged or caused to change color by electric action. The first was that of Bain, in 1845, then followed those of Bakewell, Gintl, and Bonelli.

**Electro-chemistry**, that branch of chemistry in which the reactions that occur are instituted or maintained, either directly or indirectly, by electrical agencies. The electric furnace (q.v.) affords an example of the indirect application of the electric current to the manufacture of chemical substances; the adjective "indirect" being applied in this case, because in most of the uses to which the electric furnace is put, the current does not itself perform chemical work, but merely serves to produce the high temperatures that are essential to the chemical reactions that are desired. The highest temperatures that were known previously to the invention of the electric furnace, were those that prevail in the flame of the oxy-hydrogen blow-pipe. The temperature that is attainable by the combination of oxygen and hydrogen, however, is limited by the fact that water-vapor (which is the product formed by the combination of these gases) has a definite, though high, temperature of dissociation, above which it cannot exist as water-vapor,

but is resolved again into a mixture of hydrogen and oxygen. Hence this temperature of dissociation cannot be exceeded by the oxy-hydrogen blow-pipe flame, since the gases cease to combine when it is attained. In the electric furnace no such theoretical limit exists. The heat is produced, here, by the conversion of the electrical energy into heat energy; and so long as the generation of heat within the furnace exceeds that which is lost by radiation in other ways, the temperature will continue to rise without limit, or until some essential part of the furnace itself melts or volatilizes. Calcium carbide is formed, at these high temperatures, by the direct union of carbon and lime, and is now made, commercially and in large quantities, by this process; but the combination does not occur at the comparatively low temperature of the oxy-hydrogen flame. Carborundum (carbide of silicon) is also made in the same way.

The direct action of electricity in promoting chemical combination is exemplified by the "ozonizer," which consists of a pair of glass tubes, placed one within the other, and separated by an annular space. Coatings of tin-foil, or of something equivalent to it, are applied to the inner surface of the inner tube, and also to the outer surface of the outer one; the apparatus being then connected with the terminals of an induction coil, after the manner of a Leyden jar. The annular space between the two tubes is thus exposed to a rapid alternation of electric stresses, though no actual sparking takes place through it. Gases which ordinarily show no tendency to combine with each other often will do so with greater or less readiness when mixed in suitable proportions and exposed to the alternating electric stress (known, technically, as the "silent discharge") in the annular space between the two tubes. The apparatus is called an "ozonizer," because it is chiefly used for the production of ozone from oxygen, or from air; but it has also been used, in the laboratory, for the production of many other substances. As an example of the singular power of the silent electric discharge to effect syntheses, it may be noted that hydrogen and carbon dioxide, when mixed in the proper proportions, combine directly under its influence, with the formation of formic acid.  $\text{CO}_2 + 2\text{H} = \text{H.CO.OH}$ . The combination does not occur explosively, but, like most of the other combinations under the influence of the silent discharge, it progresses quite slowly and uniformly.

The synthesizing action of the silent electric discharge has a great theoretic interest, but it has never been found to be of any particular importance for the commercial production of chemical substances. Electrolysis of dissolved salts has been found to be far more promising, and a corresponding amount of attention has been given to it. (See ELECTROLYSIS.) A large part of the copper of commerce is now refined by electrolysis, and practically all of the aluminum that is produced is reduced to the metallic form by this same method. (See ALUMINUM; COPPER; ZINC.) Common salt (sodium chlorid) is electrolyzed in large quantities in connection with the manufacture of bleaching powder (q.v.) and caustic soda; the chlorine that it contains appearing in the form of bubbles at the anode, while the sodium goes to the cathode, where it combines with a molecule of water at the instant of its liberation, generating sodium hydroxid, or



## ELECTRO CHRONOGRAPH — ELECTRO-DYNAMICS

caustic soda. The free chlorine thus obtained is used in the manufacture of bleach, or of chlorate of potassium or chlorate of sodium; and the caustic soda that is simultaneously formed at the cathode may be recovered and brought into marketable form. In mills where wood pulp is manufactured in large quantities it is not uncommon to meet with auxiliary electro-chemical plants for the manufacture of the bleach liquor that is needed for whitening the pulp; but in these plants no attempt is usually made to recover the caustic soda, nor to utilize it in any way, since the pulp-mills are often far from any market at which the soda could be sold, and the freight rates would make its recovery unprofitable. In regions that are more favorably situated, however, caustic soda is now produced by the electrolytic method in vast quantities. Barium hydrate is also manufactured in quantity by electrolysis, and its market price has been materially reduced, in consequence, within the past few years. Great attention has been paid to the electrolysis of organic substances in recent times, especially in Germany, and results that are of much value have already been obtained. Several of the great chemical works of Germany and Switzerland are now preparing certain of the coal-tar colors by electrolysis (q.v.) on a commercial scale; but the details of the processes are not made public. Goppelsroeder has given special attention to the electrolytic preparation of these bodies, and with an encouraging measure of success. Among his results of fundamental importance we may specially note the preparation of alizarin by the electrolysis of anthraquinone and caustic potash, and of aniline black (together with other coloring matters) from aniline.

The literature of electro-chemistry and of electrolysis is already extensive, and periodicals devoted to the subject, as well as societies for its study and further development, exist in several countries. The American Electro-Chemical Society, which now includes most of the workers in this field in the United States, was organized 1 Nov. 1901 in Philadelphia. Some idea of the magnitude to which the electro-chemical industry has grown may be had from the fact that the value of the annual output of electro-chemical products, in the United States alone, exceeds \$100,000,000. Germany is second, with an annual output of more than \$15,000,000.

More or less information on the subject of electro-chemistry and electrolysis may be had in any work on physical chemistry. A valuable and suggestive mass of material, bringing the subject down to about 1889, will be found in Tommasi's 'Traité d'Electrochimie.' An excellent elementary exposition of the principles of electro-chemistry is given in Lüpke, 'The Elements of Electro-Chemistry Treated Experimentally'; and Löb's 'Electrolysis and Electro-synthesis of Organic Compounds,' translated into English by H. W. F. Lorenz, is equally good for the special applications to organic chemistry. See ELECTRO-CHEMICAL INDUSTRIES.

**Electro Chronograph.** See CHRONOGRAPH.

**Electrocides,** the amber islands of Greek mythology, at the mouth of the river Eridanus. The name was applied also to the islands on the northern coast of Europe.

**Electroculture of Plants,** the employment of electric light in agriculture and horticulture.

It was determined at the Agricultural Experiment Stations of Cornell University and of West Virginia, in experiments made with the arc and the incandescent lights, respectively, that certain crops are forwarded by the light. The most remarkable instance is that of lettuce, which was brought to maturity from 5 to 10 days earlier than other plants grown in the same house, and under otherwise identical conditions. This discovery has led to the commercial application of the arc light, if not of the incandescent also, to the forcing of lettuce under glass in several of the larger New England forcing houses with the result that a gain of about three weeks' time is calculated upon for the season, thus enabling the gardener to devote his benches to one more crop than formerly, or to follow his lettuce crops with cucumbers, the favorite successor, much earlier than would otherwise be possible. Several flower crops, such as Easter lilies and sweet-peas, have been experimented upon with the result that they were forced into bloom several days in advance of others grown without the stimulus. In such cases the plants are always grown without the light until within about a month of maturity, when the light is applied for about half the night. It has been found that unless the light pass through a glass globe or pane there is a noticeable "scorching" of the foliage or flower. It is concluded that this is due to the action of the ultra-violet rays of the spectrum rays, which do not pass through the glass.

Consult various bulletins of the Massachusetts Hatch, Cornell University, and West Virginia, Experiment stations. See ELECTRIC VEGETABLE GARDENING.

**Electrocution.** See ELECTRICITY, CAUSE OF DEATH BY.

**Electrode** (Greek, *hodos*, "a way"), a term introduced by Faraday to denote the wires or other terminals by which electricity either enters or leaves a body which is undergoing electrolytic decomposition, in order to avoid an implied theory connected with the use of the older terms pole, positive pole, negative pole. He called the electrode at which the current enters the anode (*ana*, upwards), and the electrode at which the current leaves the electrolyte the cathode (*kata*, downward). The two latter terms have now been introduced in metallurgic practice; and the term electrode has become common in the more extended sense of the way by which electricity enters or leaves an instrument.

**Electro-dynamics,** that branch of electrical science which treats of the attractions and repulsions exhibited between wires or other conductors along which currents are passing. If two wires are parallel they will attract each other when currents are passing the same way along them both, and will repel each other when the currents are opposite. If the wires are inclined to each other at any angle there is not only an attraction or repulsion but a still more marked tendency to rotation which is not satisfied till the wires have become parallel and the currents flow in the same direction along them both. When there are only two straight wires these forces are feeble and require delicate apparatus for their exhibition, but by employing



## ELECTRO-DYNAMOMETER — ELECTROLYSIS

coils of wire the forces are multiplied and an instrument constructed on this principle called the electro-dynamometer has been much employed for the measurement of currents. The whole science of electro-dynamics is due to Ampère, who discovered its main facts and reduced them by ingenious experiments, combined with very abstruse reasoning, to a single mathematical formula which includes them all.

**Electro-dynamometer**, an instrument used for the measurement of electric currents by means of the mechanical forces which they exert on each other. It contains two coils of wire, one fixed and the other movable; the latter being either larger or smaller than the other so as to be able to pass either outside it or through it. The coils are set up in vertical planes at right angles to each other; they have a common centre and round the common central diameter of the coils the movable one can revolve. The terminals of the movable coil dip in cups of mercury, one of which is in connection with one end of the fixed coil and the other with one of the binding screws of the instrument. The other binding screw is in connection with the other end of the fixed coil. Hence, when the two binding screws are connected with a battery or other source of electricity the current has to pass through both coils. Its effect is exhibited by a tendency in the movable coil to set its plane in coincidence with that of the fixed coil, and in such a manner that the current will circulate the same way round both coils. This tendency is resisted by mechanical means provided for the purpose—usually by the torsion of a wire from the end of which the movable coil hangs, and the measurement is usually made by applying torsion till the planes of the two coils are at right angles. See ELECTRIC ALTERNATING CURRENT; ELECTRIC DIRECT CURRENT.

**Electro Kinetics.** See ELECTRIC DIRECT CURRENT; ELECTRIC ALTERNATING CURRENT; ELECTRICITY.

**Electrolysis**, in the strict sense, is the resolution of a fluid into its proximate constituents by the direct chemical action of the electric current; but the word is now commonly applied to all chemical operations, whether analytic or synthetic, which are performed by the direct action of the current. The phenomena that occur in the electric furnace (q.v.) are often incorrectly said to be "electrolytic"; but in most cases they are not so, electricity being used, in this instance, merely as a means for the production of high temperatures. Most of the chemical reactions that are observed in the electric furnace would occur equally well without the use of electricity, if the same high temperatures could be realized by other means; though in some cases, as in the reduction of metallic aluminum by the Hall process (see ALUMINUM), the fundamental operations really are electrolytic, and the high temperature is required merely to keep the electrolyte in the fluid state. The first recorded observation of a distinctively electrolytic action was made in 1800 by Nicholson and Carlisle, who observed that when the terminal wires of a galvanic battery are immersed in water, bubbles of gas arise from

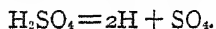
them. The correct explanation of this phenomenon was shortly afterward given by Sir Humphry Davy, who carried out an exhaustive series of experiments which laid the foundations for the practical knowledge of electrolysis that we have to-day. Davy demonstrated the tremendous importance of the electrolytic method of analysis, by applying it to study of the alkaline earths and the caustic alkalis. The nature of these substances was not previously understood; but he proved them to be the oxides of previously unknown metals, and prepared the metals themselves in the free state. By passing the electric current through melted potash, for example, he found that bubbles of free oxygen gas were liberated at one of the electrodes, while silvery globules of what is now known as potassium appeared at the other electrode. A few days later he isolated the metal sodium in the same manner, by the electrolysis of soda; and he succeeded, afterward, in demonstrating the compound nature of lime and magnesia also, by the aid of the electric current. As may be imagined, the new method aroused the keenest interest in the scientific world. Napoleon, then at the zenith of his power, offered valuable prizes for discoveries along the same lines, and had large voltaic batteries constructed, in order that French investigators might have every opportunity to carry on the work. The two great Swedish scientists, Berzelius and Hisinger, discovered many new phenomena, and elaborated a general theory of the constitution of chemical substances, based largely upon their behavior under the action of the electric current; and Faraday (q.v.) established the fundamental quantitative laws that hold true in electrolytic decomposition.

Some slight evidence has been adduced which indicates that in certain cases the passage of electricity through solids may be accompanied by slight chemical changes of an electrolytic nature, and phenomena allied to those of electrolysis have been observed in connection with high-tension electrical discharges through gases (see Thomson, 'Recent Researches in Electricity and Magnetism,' chapter 2 and appendix); but in general, electrolysis is observed only in liquids. All liquids may be divided into three classes, according to their behavior when the attempt is made to pass electricity through them. In the first class belong mercury and the other molten metals, which conduct the current readily, and without any noticeable chemical effects. In the second class belong such substances as carbon disulphid and absolute alcohol, which do not conduct the current at all, and hence are not subject to decomposition by it. Absolutely pure water probably belongs to this class, though it becomes a conductor when the smallest quantities of certain impurities are present. Water that is ordinarily called "pure" conducts electricity fairly well, but its conductivity falls off as the purity increases, and Kohlrausch and Heydweiller have shown that water that is distilled in a vacuum, and collected in a glass vessel which has been kept full of distilled water for 10 years in order to dissolve out all the soluble constituents of the glass, has a conductivity almost too small to be measured. The third class of liquids includes all those (such as aqueous solutions of the various metallic salts) in which electric conduction is always accompanied by a definite chemical change. In the

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present article attention will be confined to this third class, whose constituents are known as "electrolytes," and in which the current is said to flow by "electric conduction."

It is necessary, in the discussion of electrolytic phenomena, to distinguish between the primary effects of the passage of the electric current through an electrolyte, and the various secondary effects that may also occur; and while it is not always easy (nor even possible), in actual work, to determine, definitely, what the primary effects are, one or two cases may be cited which will serve to illustrate the difference between primary and secondary effects sufficiently for present purposes. If a current of electricity is passed through melted chloride of lead,  $\text{PbCl}_2$ , the primary effect of the electrolysis is the resolution of the chlorid into its constituent elements, in accordance with the equation  $\text{PbCl}_2 = \text{Pb} + 2\text{Cl}$ , metallic lead being deposited upon the cathode. If carbon electrodes are used, free chlorine will also appear at the anode; but if platinum electrodes are used, little or no free chlorine will be obtained, because the gas will combine with the metal of the anode in this case, with the formation of platinum tetrachlorid. The combination of the chlorine with the platinum is an example of secondary action. Again, in the electrolysis of sulphuric acid,  $\text{H}_2\text{SO}_4$ , it is known that the primary effect is the resolution of the acid into hydrogen and the radical "sulphion,"  $\text{SO}_4$ , in accordance with the equation



The hydrogen goes to the cathode, where it is set free. The sulphion goes to the anode, but it is not capable of existence in the free state, and hence some secondary reaction is inevitable. If the acid is dilute, and the anode is of platinum, the sulphion combines with water at the instant of its liberation, according to the equation  $\text{SO}_4 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4 + \text{O}$ . In this case, therefore, the effect of the secondary action is to regenerate a molecule of sulphuric acid, and simultaneously set free an atom of oxygen; and the evident products of the electrolysis are merely hydrogen and oxygen, which appear at the cathode and anode, respectively. If the acid is concentrated instead of dilute, the secondary action just described will still occur to some extent so long as the acid is not absolutely anhydrous, but free sulphur dioxide is also liberated at the anode in this case; and finally, under certain conditions, sulphur itself may be obtained at the cathode. The secondary chemical changes that occur in an electrolytic cell depend upon the nature of the electrolyte, upon the concentration of the solution, upon the temperature, and upon the strength of the current to which the primary chemical effects are due. They are often complicated and of an unexpected nature; and it is to the study of these secondary changes, under varying conditions, that industrial electrolytic chemistry must look for its further advancement.

No primary chemical changes whatever are to be observed, in an electrolytic cell, save at the electrodes; though secondary changes may occur elsewhere, on account of the diffusion of the immediate products of decomposition through the liquid of the cell. The primary changes do not depend in the smallest degree upon the size of the electrodes, nor upon any other factor save the total quantity of electricity that passes

through the cell. If a series of cells, containing electrodes of various sizes and filled with a given solution in different states of concentration, be placed simultaneously in the same circuit, so that the same identical current traverses them all, the primary products of decomposition will be the same in all, both in nature and in quantity. Moreover, if the same experiment be repeated when the several cells are filled with solutions of diverse natures, the primary products will necessarily be different from one another in kind, but when their quantitative relations are examined, it is found that they are liberated in precisely equivalent proportions. For example, if one cell contains chlorid of sodium and another contains nitrate of silver, then the quantity of chlorine liberated in the first cell is precisely sufficient to unite with the metallic silver liberated in the second one, so as to produce chlorid of silver without excess of either chlorine or silver. This statement needs one simple qualification, however, before it can be applied universally. If the two cells considered contain mercuric nitrate,  $\text{Hg}(\text{NO}_3)_2$ , and mercurous nitrate,  $\text{HgNO}_3$ , respectively, then for every ounce of mercury that is deposited from the mercuric salt, two ounces will be deposited, simultaneously, from the mercurous salt. Obviously the quantities of Hg and of  $\text{NO}_3$  that are liberated in the two cases cannot both be the same; and it is the  $\text{NO}_3$ , and not the Hg, which is liberated in equal quantities. In general, the "chemical equivalent" of an element is defined as the atomic weight of the element, divided by the valency that the element has, in the compound under consideration; and the quantities of the various elements that are liberated by a given quantity of electricity are proportional to the "chemical equivalents" of the elements, as they occur in the compounds that are submitted to electrolysis, rather than to the "atomic weights" of these elements. The number of grams of an element that are liberated, electrolytically, by one C. G. S. unit of electricity, is called the "C.G.S. electro-chemical equivalent" of that element. The electro-chemical equivalent of silver is known by experiment to be about 0.01118; and the electro-chemical equivalent of any other element may be found from this by simple proportion, as explained above. For many purposes it is more convenient to know what weight of a given element will be deposited in one minute, by a current whose intensity is one ampere. This is given, in the accompanying table, for the more important elements. The elements are here divided, for convenience, into those that are electro-positive, and those that are electro-negative; the former being those that usually appear at the cathode, and the latter those that usually appear at the anode. This classification is not very valuable in the case of complicated compounds, but it answers for the simpler ones. The data given in the table refer to the primary products of decomposition; but it is sufficiently evident that they apply equally well, so long as the visible product of the decomposition is all of one kind, whether it is primary or secondary. In the electrolysis of sulphuric acid, for example, "sulphion" is the primary product at the anode; but sulphion is incapable of independent existence, and the only visible product at the anode is oxygen, so long as the acid is sufficiently dilute. In this case the quantity of oxygen that is liberated can be

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computed precisely as though the oxygen were itself the primary product. When, as in the electrolysis of concentrated sulphuric acid, more secondary products than one are obtained, the

GRAMS LIBERATED PER AMPERE PER MINUTE.

ELEMENT	Atomic Weight	Valency	Chemical Equivalent	Grams per Ampere per Minute
<b>Electro-positive:</b>				
Aluminum.....	26.9	3	8.97	0.00562
Copper (cupric).....	63.1	2	31.6	0.0198
(cuprous).....	63.1	1	63.1	0.0395
Gold.....	195.7	3	65.2	0.0408
Hydrogen.....	1.0	1	1.00	0.000626
Iron (ferric).....	55.6	3	18.5	0.0116
(ferrous).....	55.6	2	27.8	0.0174
Lead.....	205.4	2	102.7	0.0643
Mercury (mercuric).....	198.8	2	99.4	0.0623
(mercurous).....	198.8	1	198.8	0.1245
Nickel.....	58.3	2	29.1	0.0182
Potassium.....	38.9	1	38.9	0.0244
Silver.....	107.1	1	107.1	0.0671
Sodium.....	22.9	1	22.9	0.0143
Tin (stannic).....	117.6	4	29.4	0.0181
(stannous).....	117.6	2	58.8	0.0368
Zinc.....	64.9	2	32.4	0.0203
<b>Electro-negative:</b>				
Bromine.....	79.4	1	79.4	0.0497
Chlorine.....	35.2	1	35.2	0.0221
Iodine.....	125.9	1	125.9	0.0789
Nitrogen.....	13.9	3	4.63	0.00290
Oxygen.....	15.9	2	7.95	0.00948

case is more involved. In general, however, we must remember that it is only with reference to the primary products that the electrolytic nature of the decomposition need be considered; for the secondary reactions are merely those of ordinary chemistry.

The most generally accepted theory with regard to the nature of electrolytes is that which is known as the "ionic theory," and which teaches that a salt whose solution is capable of electrolysis becomes more or less completely dissociated when it is dissolved, the respective parts into which its molecules subdivide being known as "ions." This aspect of the phenomena of solution is considered in the article SOLUTION (q.v.), and in the present place we need dwell only on those features of the ionic theory which have an immediate bearing on the subject of electrolysis. The ions into which the electrolyte is resolved, upon solution, are supposed to be associated with definite charges of electricity, which cling to the ions so long as the dissociation persists, and can only be neutralized by causing the ions to come together again so as to re-form a molecule of the original salt, or to enter into other chemical combinations with one another; neutralization being effected, in such cases, by the actual discharge of the equal and opposite electricities into one another, as the re-combining ions come together. What the ions are, into which a given salt dissociates when it is dissolved, can only be discovered by inference from certain kinds of experiments for which reference must be made to the books cited in the article SOLUTION. Our knowledge on this point is still far from complete, but we know what the ions are in most of the simpler electrolytes. When potassium hydroxid, KOH, is dissolved in water, it becomes dissociated, or "ionized," into the ions K and OH. At first thought it appears to be impossible to admit that potassium, which has so great an affinity for water, can exist in the free state in a solution; but it must be remembered that the potassium

"ion" differs from the ordinary potassium atom by the possession of a definite and considerable electric charge, which modifies its chemical behavior profoundly. As the solution is concentrated by evaporation, the potassium ions and the hydroxyl ions (OH) come together, discharge into each other, and unite to form potassium hydroxid, KOH, which is deposited in the solid form. (Some of the hydroxid remains in solution as such, the dissociation never being complete except in exceedingly dilute solutions; but this point is not essential to our present purpose, and for its further elucidation reference must be made to the article SOLUTION.) In the ionized state, the potassium is charged positively and the hydroxyl negatively; and, in general, any ion which appears at the cathode during electrolysis is charged positively in the free solution, and any ion which appears at the anode is charged negatively. Moreover, the phenomena of electrolysis prove that any given ion is always associated with the same identical charge of electricity, no matter what the salt may have been from which the ion was obtained, provided the ion has the same valency in each of the salts that are compared. The potassium ion in a solution of potassium chlorid, for example, carries precisely the same charge as the potassium ion in a solution of potassium nitrate, or of potassium carbonate. We may therefore regard the free ions in a solution as so many little buckets filled with electricity, all the buckets having identically the same capacity.

According to this view, the ions act as mere carriers of electricity, and electrolysis is not simply an accompaniment of conduction through an electrolyte, but the very means by which this conduction is effected. The electric circuit in which the electrolysis occurs may be likened to a brook. If the metallic circuit is interrupted by the insertion of a solution of some kind, the solution so inserted corresponds to a dam in the brook, through which no water can pass by direct flow. The analogy is fairly complete when the solution does not contain free ions, for then it will not act as an electrolyte, and no current can pass. Sugar, for example, does not dissociate to any appreciable extent when it is dissolved, and hence a solution which contains nothing but pure water and pure sugar cannot conduct electricity, and merely acts as an impassable barrier to the current. When the solution contains a salt (such as sodium chlorid) which is largely or wholly dissociated, the free ions act like a molecular bucket brigade, passing the water across the dam in the brook, or the electricity across the gap between the two electrodes in the electrolytic cell. In the electrolysis of copper sulphate, for example, the phenomena are as follows: The formula of the sulphate is  $\text{CuSO}_4$ , and the free ions in the solution (and hence also the primary results of the decomposition) are copper and "sulphion,"  $\text{SO}_4$ ; the copper ion being charged positively, and the sulphion ion negatively. The electrodes that are immersed in the electrolytic cell are also kept continuously charged by the battery (or dynamo) with which they are connected; the cathode being negative and the anode positive. The positively charged copper ions in the solution are therefore attracted by the negatively charged cathode, just as a positively charged pith ball is attracted by a negatively charged body in the air. Hence they move towards the

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cathode, and when they reach it they discharge their electricity upon it, thereby ceasing to be ions, and becoming transformed into atoms of ordinary copper, which are perforce deposited upon the cathode. The sulphion ions simultaneously move towards the anode, upon which they discharge the negative electricity that they carry. The ionic charge is essential to the continued existence of the sulphion, however, and when this charge is lost, the sulphion must either break up into sulphur dioxide and free oxygen, or else combine with some other substance to form a new compound. If the anode is made of platinum or carbon, the sulphion usually combines with a molecule of water with the liberation of free oxygen, as already explained in connection with the electrolysis of dilute sulphuric acid; but if the anode is made of a material that is less resistant to chemical action, the sulphion may combine with the anode itself instead of with a molecule of water. For example, when the anode is of copper, the sulphion, at the moment that it loses its electric charge, combines with an atom of the anode so as to form a molecule of copper sulphate.

The solvent, according to this theory, is to be regarded as an insulator, through which the electricity is passed by the ionic bucket-brigade. There is no real "conduction" through an electrolyte; but the positive charges that the ions bring to the cathode diminish the charge of the cathode so that more negative electricity must flow to it from the battery (or the dynamo), in order to maintain its potential; and, similarly, the negative charges that the ions carry to the anode require a constant supply of positive electricity from the battery, in order that the potential of the anode may be maintained. The general effect upon the circuit, therefore, is the same as though there were an actual conduction of electricity through the electrolyte. (For a further elaboration of the ionic theory of electrolysis, consult Whetham, 'Solution and Electrolysis.' See also SOLUTION.)

By a detailed study of the secondary chemical actions that occur when salt solutions are electrolyzed, it has been found to be possible to isolate many of the metallic elements by electrolysis, when they are present in a mixed solution; and a promising system of "electro-chemical analysis" has been based upon this fact. Copper may be separated from cadmium, for example, by electrolyzing a solution of their mixed salts, in which free nitric acid is present, the copper being obtained in the metallic form, while the cadmium remains in solution. If the same solution is neutralized by potassium hydroxid, and then electrolyzed after the addition of potassium cyanide, the cadmium is deposited, while the copper remains in solution. The successful application of the principles of electrolysis to analysis requires an extensive knowledge of the secondary reactions that occur at the electrodes, however, as well as a full understanding of various practical conditions that must be carefully attended to. For these consult: Smith, 'Electro-Chemical Analysis' (1903), together with the references therein given. See ELECTRIC FURNACES; ELECTRO-CHEMICAL INDUSTRIES; ELECTRO-CHEMISTRY; ELECTRON; SOLUTION.

**Electrolysis of Gas and Water Mains**, the eating away of metal in underground pipes

caused by fugitive electric currents. Electric street railway systems are largely responsible for such electrolysis. The subject first came under discussion among electricians in 1892, when the matter was brought to public attention by various gas and water companies. Metal in water mains frequently becomes so badly decomposed that the pipes burst and great damage results. The remedy for the evil is to provide ample and unfailing means for the control of stray electric current and its return to the power house.

**Electrolyte**, a compound which is decomposable, or is subjected to decomposition, by an electric current. See ELECTRIC STORAGE BATTERY.

**Electro-magnetic Engine**, a machine in which the motive power is derived from electromagnets excited by an ordinary voltaic battery, or by the more modern secondary battery. In Froment's engine, a cylinder furnished with iron bars or armatures, turned in front of the poles of an electro-magnet, the current being cut off automatically as each bar passed the poles. Most modern dynamo-machines can be used as motors, and in this capacity can be employed for railways, street cars, and vehicles.

**Electro-magnetic Force**, the induction current in an electro-magnetic machine; the magnetism which it excites; the attractive force; and the lifting power which it possesses.

**Electro-magnetic Induction**. See INDUCTION.

**Electro-magnetic Telegraph**, a signaling, writing, printing, or recording apparatus, in which the impulses proceed from a magnetic force developed by voltaic electricity. The principle is that a mass of soft iron is rendered temporarily magnetic by the passage of a current of electricity through a surrounding coil of wire. It differs from the electric telegraph properly considered, and also specifically from the magneto-electric telegraph. The earlier electric telegraphs were all what their name implies, and not electro-magnetic. The pioneers in its discovery were Sömmering in 1808, and Prof. Coxe, of Pennsylvania, about the same year. Then followed Oersted in 1820. In 1832 Prof. Morse began to devote his attention to the subject of telegraphy, and in that year, while on his passage home from Europe, invented the form of telegraph since so well known as "Morse's." A short line worked on his plan was set up in 1835, though it was not until 20 June 1840, that he obtained his first patent. His first idea was to employ chemical agencies for recording the signals, but he subsequently abandoned this for an apparatus which simply marked on strips of paper the dots and dashes composing his alphabet. In 1840 Wheatstone, whose attention seems to have been drawn to telegraphy about 1834, patented a dial instrument, on which, however, he afterward adopted several modifications.

**Electro-magnetic Theory of Light**, a theory propounded by J. Clerk Maxwell, that light is an electro-magnetic phenomenon. Though the theory has found able advocates, it has not received general acceptance among physicists. The discovery of the Roentgen rays tends to establish the correctness of the theory.

## ELECTRO-MAGNETIC WATCH — ELECTRON

Certain phosphorescent light has, like the X-rays, the power of penetrating bodies opaque to ordinary light, which seems to furnish a connecting link between ordinary light and the Roentgen rays, and the discovery by Marconi, that electric vibrations can be projected through space in straight lines, and be reflected and refracted like light—indeed, made to conform to all of the manifestations characteristic of light—seems to leave little room to doubt that electricity and light have a common origin. See WIRELESS TELEGRAPH.

**Electro-magnetic Watch.** See ELECTRIC SIGNALING.

**Electro-magnetism.** Magnetism can be strongly excited in soft iron, by means of an electric current. For this purpose the bar to be magnetized is surrounded by a helix consisting of several coils of insulated copper wire wound upon a bobbin. The circuit being closed, the bar becomes powerfully magnetic and may be made to attract a number of nails. On breaking the circuit the magnetism disappears, and the nails at once fall away. The magnetism thus called forth is termed "electro-magnetism." The bar magnetized in this way becomes a perfect magnet; in other words, it acquires a north and a south pole. The polarity of the bar depends upon the direction of the current, and also upon the twist of the wire in the helix. With the same kind of helix, that is, whether the twist be from left to right or right to left, the polarity is reversed by changing the direction of the current. Again keeping up the same direction in the current, the polarity is reversed by changing the helix.

**Electro-magnets.** A French inventor, Ampère, discovered the permanent magnetization of steel needles, and the temporary magnetization of iron filings by means of the electric current. He adopted the method of placing the steel needle or bar within a coil or helix of copper wire, and in doing so he found that if the helix was wound from right to left over the needle, as at the end of the needle at which the positive current entered became the north marked pole, but if wound from left to right the end at which the current entered became the south pole. M. Pouillet constructed an electro-magnet for the Faculty of Sciences at Paris, consisting of two horseshoes, each wrapped with 10,000 feet of copper wire, and so arranged that the poles of contrary names should be in contact. With a current of moderate intensity this apparatus supported a weight of many tons. A small horseshoe electro-magnet with a core of  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter, and 5 or 6 inches long, having three or four layers of covered wire of the thickness of bell wire twisted around each limb, will lift 10 or 12 pounds when excited by only a single pair of Smee's battery, with plates 4 inches square. In constructing an electro-magnet the use of cast iron must be avoided, as it partakes of the nature of steel; malleable iron should be used; and even the purest and softest that can be made always retains a certain amount of attractive force after the current ceases. When a rapid motion of the armature is required the effect of this residual magnetism may be neutralized by covering the surfaces of contact with varnish or thin paper. The principle of the electro-magnet is employed

in the dynamo and motor for the purpose of producing a powerful magnetic field in which the rotation of the armature takes place. For this purpose the whole or a portion of the armature current may be employed in the field magnets for the purpose of exciting the field. See MAGNET; ELECTRO-MAGNETISM.

**Electro-massage.** See ELECTROTHERAPEUTICS.

**Electro-metallurgy and Electric Smelting.** See ALUMINUM; COPPER; GOLD; METALLURGY; PLATINUM; SILVER; ZINC.

**Electrometer,** an instrument for measuring differences of electric potential between two conductors through effects of electrostatic force, and not, as in galvanometers of all varieties, through certain electro-magnetic effects of electric currents produced by them. See ELECTRICITY.

**Electro-motive Force,** a term used in connection with batteries and other sources of electric supply to denote the difference of potential existing between the plates or terminals, in consequence of which there is a tendency for a current to flow when the plates are connected by a conductor. See BATTERY; ELECTRICITY; MOTOR; PRIMARY BATTERIES.

**Electro-motive Series,** applied to the metals in a voltaic couple, metals so arranged as to have the most electro-positive at one end, and the most electro-negative at the other. Ohm's law on the subject is that the intensity of the current is equal to the electro-motive force divided by the resistance.

**Electro-motograph,** a name given to a peculiar telephone receiver invented by Edison. See TELEPHONE.

**Electron,** one of the ultimate particles of which (according to the views now tentatively held by physicists) the atoms of matter are composed. The "electron hypothesis" is still in its infancy, and years will probably elapse before its truth or falsity can be demonstrated with any degree of certainty. It teaches that the atoms, which were formerly supposed to be simple bodies that are incapable of subdivision, or bodies which at all events do not undergo division in the ordinary processes of nature, are really systems of some considerable complexity, built up of thousands of still tinier "electrons," each of which is endowed with a permanent electric charge. The definite development of the electron hypothesis originated with the study of electric discharges through highly rarefied gases. Crookes, for example, boldly took the position that the luminous streams ("cathode rays") that proceed from the cathodes of highly exhausted vacuum tubes are composed of tiny material particles that are moving away from the cathodes like storms of projectiles. In support of this view he exhibited many ingenious and beautiful experiments, in which the corpuscular torrents were caused to turn paddlewheels and heat targets to whiteness. He did not definitely commit himself to any theory as to the precise nature of the corpuscles, but he recognized them as being somehow different from the ordinary molecules of matter, and he consistently and persistently maintained that the matter in these tubes is in a "fourth state," which is essentially



## ELECTRON

different from the familiar gaseous, liquid and solid states, which matter has long been known to be capable of assuming. This fourth state he called "radiant matter." His views were opposed by many competent authorities, who adhered to the view that the cathode rays are wave-like phenomena, due in all probability to the extraordinary electrical stresses that are set up in the luminiferous ether within the tubes, by the induction coil that is used to produce the discharge. As further experimental evidence has accumulated, however, the substantial correctness of Crookes' views has become increasingly evident, and the corpuscular nature of the cathode rays is now generally admitted. Numerous exceedingly ingenious experiments have been devised for determining the masses of these corpuscles (or "electrons"), and the magnitude of the electric charges that they carry; and the results are most surprising. Let  $m$  be the mass of an electron,  $v$  the velocity with which it is moving in the cathode stream, and  $e$  the electric charge that is associated with it. Then it can be shown theoretically that in a magnetic field the electron will describe a curved path instead of a straight one. If the magnetic force acts at right angles to the direction of the stream, and has an intensity  $H$ , the path of the electron will

be a circle of radius  $\frac{mv}{eH}$ . By observing the

actual curvature of the cathode stream under the influence of a known magnetizing force  $H$ , we can therefore find the value of the expression  $\frac{mv}{e}$ .

It is also known that the tendency of the magnetic force to produce curvature of the path of the electron can be neutralized by so arranging the experiment that the cathode stream is simultaneously exposed to a static electrical force of a particular intensity  $F$ , and acting in a direction that is perpendicular both to the cathode stream and to the magnetic force; the intensity,  $F$ , of the static force being such that the relation  $F = Hev$  is fulfilled. By experiment, it is possible to find the numerical value of  $F$  by varying the electric force acting across the cathode stream until, under the combined influence of the static and magnetic forces, it is seen that the cathode stream is perfectly straight. When this condition is fulfilled, the equation just given shows that the velocity of the electron can be found by merely dividing the observed value of  $F$  by the observed value of  $H$ . The results obtained in this way indicate that the velocity of the electrons in the cathode stream is pretty much the same, whether the tube contains air, hydrogen, or carbon dioxide; it being about 2,500,000 centimetres per second (that is, about 75,000 miles), or something like one twelfth the velocity of light. The value of  $v$  being known, and the ratio of  $\frac{mv}{e}$  to  $e$  being also known by a previous experiment in which the static field is omitted and the magnetic force allowed to act alone, we are at once in

position to calculate the value of  $\frac{mv}{e}$  or the

charge that is carried by the electron, per unit of its mass. The numerical result so obtained (and which is sensibly the same for all gases) is that each gram of the electron's mass, in the cathode stream, carries a charge of about

$10^8$  coulombs. Now in electrolysis (q.v.) the ions of hydrogen carry a charge of about 96,000 coulombs per gram of their mass; or, in round numbers,  $10^5$  coulombs per gram. Hence if the electrons in the cathode stream have a mass equal to that of the hydrogen ion in electrolysis, they must carry an electric charge that is 1,000 times as great as that carried by the hydrogen ion; and conversely, if (as many authorities consider probable) they carry the same electric charge as the hydrogen ions carry in electrolysis, it follows that the electron has a mass only about one one-thousandth as great as that of the hydrogen ion (or atom). The reasoning given above appears to be beyond reproach, and it is substantiated by other methods of experiment that cannot be here considered. J. J. Thomson, who has been especially prominent in connection with the development of the electron hypothesis, endeavored to determine which of the alternatives suggested above corresponds with the real facts of the case. His method for doing so is described in full detail in the 'Philosophical Magazine' for December 1898, but is too technical to be given in the present article. His general conclusion is, that the charge is the same upon the electron as it is upon the hydrogen ion in ordinary electrolysis; and hence that the mass of the hydrogen atom is 1,000 times as great as the mass of an electron. It is not certain that this conclusion will be fully sustained by future investigations, because some of the assumptions and observations upon which it is based have not yet been established beyond controversy. It may yet be found that the electron and the hydrogen atoms are not greatly different in mass, but that the electron carries a far larger charge of electricity than the ion that is concerned with electrolysis. Assuming the correctness of Thomson's views, certain physicists have elaborated fascinating hypotheses as to the constitution of matter, and have even attempted to explain the genesis of the definite species of matter that we call elements. (See ELEMENT.) It is not at all improbable that matter really is of only one fundamental kind, and that we shall one day know how the elements differ from one another. It is even possible that the electron hypothesis is the key that is to unlock this secret; but the subject is still too new for any definite and valuable judgment to be passed upon this phase of it. In general, there is a tendency towards the belief that the electrons are the fundamental units of which the atoms are composed; and according to this view they may be likened to the bricks with which buildings are constructed in human architecture. The electrons of all bodies are supposed to be identical with one another, and the atoms of any two elements, such as hydrogen and iron, for example, are supposed to differ only in the number of the electrons that they contain, and in the way in which these electrons are grouped. It is known that a swiftly-moving charge of electricity would show inertia-like effects, even if it were not associated, in its motion, with any body possessing true mass. Hence it has been thought probable, by many authorities, that the inertia of matter is capable of explanation in this way, if it is admitted that atoms are really composed of electrons flying around in orbits, about a mean configuration that is essentially stable so long as it is not



## ELECTRO-OPTICS — ELECTROTAXIS

subjected to external disturbances of too great a magnitude. These speculations, and others of the same sort, are given in Sir Oliver Lodge's interesting lecture "On Electrons," as published in the 'Scientific American Supplement,' beginning with the issue for 16 May 1903 (No. 1428). It is probable that the views now held upon these and other allied subjects will soon undergo a substantial modification of some sort, for it is next to impossible for the human mind to conceive of any such thing as a disembodied electric charge moving about in an orbit; and while such a description of the ultimate nature of the electron may serve well enough as a starting point upon which to base mathematical equations that shall explain the phenomena that we can observe and measure in the laboratory, it can never satisfy the craving of the physicist for a definite mental image of what is really going on in the atom. Whether such a mental image is possible or not, or whether or not it is logical to strive for its attainment, are fair questions for discussion; but it is certain that the general trend of physics has been in this direction in the past, and there is no reason to suppose that the same tendency will not be equally manifest in the future. See ELECTRO-CHEMISTRY; ELEMENTS.

**Electro-optics**, a branch of electrical science treating of the relation of electricity to light.

**Electrophorus** (Greek, *pherō*, "to bear"), an instrument for obtaining electrification by means of electrostatic induction. The following is the theory of the instrument: The brass plate, when set down on the sole, touches it only in a few points, owing to the rigidity and the unevenness of both plates. If it were then lifted it would be found to carry away from these points a faint negative charge. But the greater part of it being not in actual contact with, but only in close proximity to, the remainder of the resinous plate, which is negative, the brass plate becomes excited by induction, and when the finger is brought near, negative electricity passes from the brass plate to it (just as in the elementary experiments on electrostatic induction), positive electricity being held attracted by the negative electricity of the resinous plate. When the brass plate is raised the positive electricity is set free, and is ready to be discharged. The use of the metal form, or the tinfoil pasted below the ebonite, is to admit of perfectly free charge and discharge of the lower surface of the resinous plate when the brass plate is lifted and set down. See ELECTRICITY.

**Electro-photo Micrography**, the art of photographing, by means of the electric light, certain objects magnified by the microscope.

**Electro-photography**. See PHOTOGRAPHY.

**Electrophysiology**, the science which treats of electric phenomena produced through physiological agencies.

**Electroplating**, the covering of baser metals by means of the electric current with a coating of precious metal, such as gold, silver, or nickel. German silver, or copper and its alloys are excellently adapted to receive electroplating. The process is begun by carefully cleaning and scouring the object or article to be plated, so as

to remove all trace of oxide or other impurity from its surface and interstices. A thin film of mercury is then given to it by plunging it into a bath of nitrate of mercury; by this means the plate is more closely adhesive to the under metal. The bath of gold, silver, or nickel in which the plating process is completed contains 100 parts of water, 10 of potassium cyanide, and 1 of the cyanide of the precious metal to be applied as plating. After being suspended in this bath, and covered with a proper amount of the deposit the plated articles are withdrawn, and burnished. The further details of this beautiful process must be learned from the technical handbooks which deal with the subject. The literature of electroplating is voluminous, but Brunor's 'Practical Electroplater' is an admirable guide to the mastery of the process.

**Electropoion**, a mixture of sulphuric acid, bichromate of potash, and water used as the liquid for batteries in which zinc and carbon are the poles. See BATTERY.

**Electropyrometer**. See PYROMETER.

**Electroscope**. A simple form of this instrument consists of a glass phial provided with a cork; through the cork there passes a brass rod, terminated above with a small brass disk, and below with a stage from which there depend two gold or Dutch metal leaves. It is used to indicate the smallest quantity of electricity with which a body may be charged. A rubbed glass tube, for example, is brought near the metal disk; it acts by induction upon it, repelling the positive fluid, and attracting the negative fluid to the upper side; the positive fluid rushes to the leaves, and in consequence of their being similarly charged, they repel each other and stand apart. If the charge of the electrified body be very small, it may be necessary to touch the disk, in that case the electricity is conducted to the leaves and they are repelled. Thus the smallest charge of electricity may be rendered apparent. The kind of electricity with which a body is charged may be revealed by this instrument. For this purpose, while the excited glass tube is held, let the disk be touched with the finger, the positive electricity is drawn from the leaves, passes through the negative, and is led away to the ground. Let now the finger be removed, and immediately afterward the glass tube, then the negative electricity diffuses itself and passes to the leaves, which therefore diverge, being charged with the same kind of electricity. A body (whose electricity is to be ascertained) is now brought near the metal disk. If the leaves diverge farther, it indicates that more negative electricity has passed to them, and therefore the body is charged with negative electricity. If the leaves collapse, the body is charged with positive electricity.

**Electrostatics** is the part of the science of electricity that treats of the phenomena of electricity at rest. The terms *electrokinetics* and *electrokinematics* are also employed by the most philosophical writers on electricity; but they cannot be said to be at present in popular usage. See ELECTRICITY.

**Electrotaxis**. See ELECTROCULTURE OF PLANTS.

## ELECTROTHERAPEUTICS — ELEMENT

**Electrotherapeutics** is the art of applying electrical currents to the treatment of diseased conditions. As a means for treating various forms of nerve lesion, electricity has a distinct place in the armamentary of every reputable physician; but there is little doubt that at the present time a vast army of quacks and charlatans prey upon the community, by reason of their lack of knowledge as to the precise limits within which electricity is of service. Thus, there are on the market electric belts, electric garters, electric amulets, electric rings, electric hair restorers, electric ozonizers and all sorts of electrical monstrosities which from a therapeutic standpoint have absolutely no value.

At the present time three or four types of electrical current are used in medicine: frictional or static electricity induced by a Holz machine; galvanic electricity and faradic electricity produced by chemical agencies or by mechanical devices. To this could be added the electric or X-ray and similar light-producing agents. Treatment by these latter agents is not electrical treatment, it is light treatment and will be considered under that head. The action of all the forms of electricity is closely analogous. They are marked tissue stimulants, bringing about renewed activity in the cells of the organs subjected to their influence. Electricity acts, then, as nothing more than a tonic. Its action is most manifest on the muscles and nerves. It should be applied by intelligent physicians for definite aims. It is pitifully ludicrous to see the waste of time, money, and energy expended by many sick people in the abuse of electrical toy batteries. One could better cook a dinner with a box of matches than obtain any therapeutic value from the vast number of toy batteries sold by ignorant, if not unscrupulous, dealers.

**Electrotint**, a method of tracing drawings, etc., for printing by the action of electricity on a copper plate. The design is drawn in some varnish not affected by acid and placed in an electro-bath, the lines being thus brought out in relief.

**Electrotonus**, the altered state of a nerve or muscle during the passage of a galvanic current through it.

**Electrotrophism.** See ELECTROCULTURE OF PLANTS.

**Electrotype**, a copy of a form of type, made by means of electricity. A page of the type is covered with wax, which is driven into the interstices by powerful pressure. The face of the wax mold is covered with plumbago to give it a conducting surface to which the metal will adhere. The positive pole of a battery is attached to the mold, and the negative to a copper plate, and both are placed in a bath of sulphate of copper in solution. The copper is deposited on the face of the mold in a thin film, which increases in thickness as the process continues. The shell having attained the thickness of a stout sheet of paper, the mold is removed from the bath, the shell detached and strengthened by a backing of type-metal. The back of the shell is first coated with tin, and the shell is then placed face downward on a plate, and over a bath of molten type-metal. When it has attained the requisite heat, a quantity of the metal is dipped up and floated over

the back of the shell. When cold, the plate is reduced to an even thickness by a planing-machine. For printing, it is mounted on a wooden backing. Another mode of obtaining electrotype plates from a letter-press form is by a mold of gutta-percha, brushed with graphite and immersed in the electro-plating bath. Gutta-percha is also used for obtaining intaglio molds and then cameo impressions from woodcuts, for printing. See also ELECTRO-CHEMISTRY, INDUSTRIAL; PHOTO-ENGRAVING; PRINTING.

**Elec'trum**, a substance mentioned by Greek and Latin writers, with regard to the nature of which there has been much discussion. The term was used with different meanings; it originally meant gold, and was then applied specially to native gold, containing quantities of silver, copper, and other metals. The term employed for this native alloy was transferred to the artificial alloy of gold and silver, afterward made, and was also applied to amber on account of its color and inferior lustre.

**Elegy**, properly, a poem of mourning. The Greeks and Romans, however, employed the term to denote a poem written in elegiac verse, whatever its character. This elegiac verse was the distich, consisting of the hexameter alternating with pentameter. In modern times the term elegy is usually applied to any serious piece in which a tone of melancholy pervades the sentiments, as in Gray's 'Elegy Written in a Country Churchyard.'

**Elegy Written in a Country Churchyard**, a poem by Thomas Gray, and published in 1751. Its sincerity and simplicity of thought and language made it immediately popular, and it rapidly passed through a number of editions, and has since been often reprinted. It is thought that the churchyard is that of the parish church at Stoke Pogis.

**El'ement**, in chemistry, a substance that cannot be decomposed into other substances. Something like 77 different substances are now admitted by chemists to be elements, and a number of others are tentatively assumed to be so, until further evidence, for or against their elemental character, is accumulated. (A list of those that are now admitted is given under ATOMIC THEORY.) Much speculation has been indulged in, concerning the fundamental structural differences that subsist between the atoms of the different elements, but no universally acceptable explanation has yet been offered to account for the fact that the thousands of compounds that have been studied are all composed of so small a number of essentially different constituents. The alchemists believed that every apparent "element" can be modified, or "transmuted," into every other one, and much labor was expended in the effort to transmute the baser metals into the "nobler" or more valuable ones. We now know that the problem of transmutation, if it is capable of solution at all, is at any rate far more serious than it was believed to be in the early history of chemistry. But there are numerous indications which suggest a relationship among the substances that are now accepted as elements, and it may yet prove to be possible to transform lead into gold, or tin into platinum. For some years past Sir William Crookes has been a consist-

## ELEMENTAL SPIRITS — ELEPHANT

ent advocate of the theory which teaches that all matter is fundamentally the same, and he has shown that some of the "elements" can be resolved, by fractionation, into substances which exhibit spectra that differ from one another in a marked manner, any two consecutive members of the series showing close similarity in their spectra, while the extreme members of the series are totally dissimilar. (See his lecture before the Berlin Congress of Applied Chemistry, entitled 'Modern Views on Matter,' in 'Science' for 26 June 1903.) The theory of matter which is in favor at the present writing teaches that all atoms are composed of electrons (q.v.), which are all alike, but which are grouped together in various ways, and in various numbers, to form the atoms of the elements. If this view stands the test of further research, the possibility of transmuting the elements into one another may not be altogether fanciful. The newly discovered element radium (q.v.), which appears to possess the singular power of continuously emitting streams of free electrons, occurs in nature in certain varieties of the mineral uraninite. It is notable that the inert gas helium (q.v.) also occurs in this same mineral, though it appears to be present in the free state, and never in actual chemical combination. It has been suggested that we are here face to face with a real case of transmutation of elements, the electrons that are emitted by the radium being slowly built up, within the uraninite, into new systems, which are nothing less than atoms of helium. See MOLECULAR THEORY; PERIODIC LAW; RADIATION; RADIUM.

**Elemental Spirits**, beings who, according to the popular belief of the Middle Ages, presided over the four elements, living in and ruling them. The elemental spirits of fire were called salamanders; those of water, undines; those of the air, sylphs; and those of the earth, gnomes. Paracelsus wrote a treatise upon them, and they play a part in Pope's 'The Rape of the Lock.'

**Elemi**, a name given to fragrant resinous extracts obtained chiefly from trees of the order *Burseraceae*. The hard elemi, most abundant in the West Indies, is obtained from species of *Bursera*, and is either yellowish or greenish, sometimes opaque and sometimes translucent, has a fatty lustre, is easily pulverized, and very fusible. It is heavier than water, in which it is insoluble, although it is readily dissolved in either turpentine or alcohol. African elemi is an extract of *Boswellia freereana* or *Santiriopsis balsamifera*; Manila elemi a product of *Canarium commune*; and the Mauritius variety is obtained from *Canarium paniculatum*. A large part of the elemi of commerce is produced from trees of different genera of the same family growing in tropical America. Elemi is a regular constituent of spirit varnishes, and the Manila kind is used in plasters and ointments. In Eastern countries it is also used as incense. Its active principle is a volatile oil obtained by distillation.

**Elephant**, the largest of living land animals, the two species of which constitute the family *Elephantidae*, of the sub-order *Proboscidea*. The better-known species (*Elephas asiaticus*) is native to the jungles of India; while the other species (*E. africanus*) is found in the forests of Africa.

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The elephant is a huge ungainly creature with an enormously heavy body, mounted on four short, columnar legs, the hinder ones bending like knees when he lies down, as he doubles them behind, and not under him; his tail is long and tapered, ending in a bunch of coarse hair; otherwise the wrinkled bluish-gray hide is quite hairless. His head is large, with big pendulous ears, small eyes, and a nose, prolonged into a proboscis or "trunk," which reaches quite to the ground when he stands erect. The average male elephant is 8 or 10 feet high, and weighs 5 tons or more. The incisors of his upper jaw are prolonged into tusks, which are, however, less useful to him, as weapons, than is his trunk. This organ enables the animal to pick up things from the ground, and to reach fruits or leaves many feet above his head, and it also conveys water to the mouth. Indeed, so great is the tactile sense of this singularly flexible proboscis that it has been likened to a hand. It is also its owner's chief weapon of offense and defense; for with it he can catch and crush a man with ease, or hurl aside the tiger. The age which this huge creature attains is proportionate to its size; for captive specimens have been known to live a hundred years, and scientists believe that, in a wild state, it may live many years longer.

The Indian elephant (*Elephas asiaticus*) differs from the African in having a longer head with concave forehead and smaller eyes and ears; in this species, also, the hind feet are often five-toed, whereas in the African they are never more than four-toed. Though the two species present some differences as to dentition, the special peculiarity in the structure of the molars is common to both. These teeth are of great size, and are formed of vertical plates of dental bone, separately covered with enamel, and welded together by a bony "cement," so that each tooth looks like a number of teeth, cemented together. In both species, also, there are no canine teeth, and no incisors in the lower jaw; while the incisors of the upper jaw are developed into tusks, often weighing 150 to 200 pounds each. These tusks furnish the ivory (q.v.) which is so much esteemed for ornamental purposes.

The Indian elephant has been for thousands of years the servant of man. From the earliest ages he has borne the Oriental warrior into battle, has hauled his stores and ammunition, and has even been taught to wield weapons. In peace he has piled logs and huge blocks of stone as unremittingly as a derrick, and has been the main feature in the processions of the native princes. In these last and always spectacular functions, the elephant's anklets, saddle-cloth, and trappings are often encrusted with gold and jewels; and the prince who sits in the canopied howdah on his back, is not more gorgeously attired than his elephant. In this connection, also, the albinos of the elephant are prized far more highly than the ordinary sort; in Siam, indeed, the white elephant is royal and venerated. The catching of these elephants singly, or in herds, is by no means an easy task. In former years they were caught in pitfalls, but this practice has been abandoned, because the creatures were frequently injured. Modern methods are varied. Sometimes male elephants are decoyed by tame females trained for that purpose, until they are in close proximity to the hunters. These entangle their uncon-

## ELEPHANT—ELEPHANT-APPLE

scious victim's legs in stout ropes, and when, eventually, he finds himself trapped, he fights until exhausted. When, however, herds are hunted, they are driven by an ever narrowing circle of hunters toward the mouth of a strongly built stockade, or "keddah." When, after many days, surrounded and enclosed by their pursuers, they rush into the stockade, the great gate is shut upon them. They are then tamed by a variety of methods, which differ, as the stockades do, according to locality. Once caught, the elephant is easily trained, a few months being, usually, sufficient to teach him all he needs to know. Methods of training vary in detail; but, after the first severe lessons, the trainer usually finds gentleness effective. The driver or mahout sits upon the elephant's neck and manages him by words and by the use of a small iron-pointed stick. Once tamed, elephants, except in cases where they become "bad," and have to be shot like mad dogs, are so gentle that children may be trusted to play with them.

Besides the differences between the two species, already noted, the African elephant is not as amenable to domestication and confinement as the Asiatic, and is the chief source of the world's supply of ivory. Indeed, the African elephant generally succumbs to disease and dies in confinement, while the only change noted in the Asiatic under the same circumstances, is that the species generally does not breed in captivity. The African elephant is peculiar in that the great tusks, twice as large as those of the Asiatic species, are present in both male and female, while in the Asiatic species they are found only in the male. Because of the demand for these, the African natives have made war upon the female as well as the male, and this leads naturally to a diminution of the species, as the number of tusks shipped has increased rather than decreased each year. The African elephant is now never used as a beast of burden, though in ancient Egypt he may have been so utilized.

Elephants generally live in large herds, each herd led, and apparently governed, by a leader, usually the largest of the party. So marked a family resemblance exists between members of the same herd that, in India—where they are classed as "high caste" and "low caste"—different herds are easily distinguishable. The African elephants live in mountainous regions, the Asiatic ones in deep forests, whence they can issue to play in and drink of the waters in which they find so much enjoyment. Here, too, their trunks are serviceable. They are used to squirt water over the creatures' backs, or to spout it, playfully at their neighbors. Elephants also caress each other by means of their trunks.

The anecdotes illustrating the docility, affection, sagacity, irritability, capriciousness, and revengeful spirit of the elephant, are innumerable, and may be found in various well-known books on natural history. The natural enemies of the elephant, beside man, are the tiger and the rhinoceros, and the nasal horn of the latter often proves a more formidable weapon than the trunk and tusks of the elephant, and the sight of even a dead tiger is said to be enough to excite most elephants into a transport of fury.

**Fossil Elephants.**—Mammoths, whose remains have been dug up, frozen or fossilized. The two living species of elephant are the last

survivors of a group which formerly spread over all the great continents, and inhabited temperate and arctic as well as tropical regions. Various extinct species of the elephant, commonly called mammoths (q.v.), have been found in every country of Europe, in Asia, and Africa, and in the New World, from Alaska to Argentina. In Siberia their remains are so abundant that fossil ivory forms a considerable article of commerce. The mastodons (q.v.) distinguished from the true elephants by less specialized grinding teeth, had an almost equally extensive range, but inhabited more especially the temperate regions during the Pliocene and Pleistocene epochs. Primitive mastodons lived in Europe and North America during the Miocene Epoch; they were of smaller size than the later mastodons, and had two small tusks in both upper and lower jaws; these tusks have a band of enamel on the outer surface, and in the oldest species the upper tusks curve downward and the lower ones upward in a manner that indicates their origin from chisel-shaped incisors like those of rodents. The trunk in these primitive mastodons appears to have been much shorter than in the present elephant, and in every respect they were much less specialized. From this stage up to the present elephant a complete evolutionary series can be traced, but the earlier stages in the evolution of the *Proboscidea* are not known. It appears certain that they did not originate either in North America or Europe, but migrated to those regions during the Miocene Epoch, from some other continent. Prof. Osborn has considered them as probably of African origin; while Prof. Ameghino has recently announced his discovery of the early stages of their evolution in Argentina. The *dinotherium* (q.v.) of Europe was a side branch of the *Proboscidea*, contemporary with the primitive mastodons, and more primitive in the grinding teeth, but with more specialized tusks, the upper tusks being lost and the lower ones enlarged, while the reverse is the case in the mastodons and elephants.

**Elephant, Order of the,** an ancient Danish order of chivalry. It is said to have been instituted about the end of the 12th century by Canute VI. to perpetuate the memory of a Danish crusader who had killed an elephant in the Holy Land. It was renewed by Christian I. in 1462, and placed on its present footing in 1693 by Christian V. It is the highest of the Danish orders. The number of members, not counting those of the royal family, is restricted to 30. Foreign sovereigns are exempted from these restrictions. The fête of the order is held on 1 January, when the knights meet in the chapel of the order in the castle of Fredericksburg, taking rank by seniority upon seats over which are suspended their arms and devices. The insignia of the order are an enameled white elephant, with a negro mahout, bearing on a blue housing, bordered with gold and crossed with white, a sculptured tower. On state occasions the elephant is worn attached to a chain composed of elephants and castles of gold, with a letter D in gold to represent *Dania* (Denmark). The device of the order is *Magni animi pretium*.

**Elephant-apple,** a large and handsome East-Indian tree (*Feronia elephantum*). It be-



ELEPHANT BEETLE.





## ELEPHANT BEETLE — ELEPHANT'S-FOOT

longs to the orange family, and produces a large gray-colored fruit with a very hard rind.

**Elephant Beetle**, one of the great cetonian beetles of the genus *Megasoma* of Central and South America; specifically *M. elephas*. It reaches a length of three to four inches, and is black, delicately pitted. A related species (*M. thersites*) occurs in California.

**Elephant Fish** (*Callorhynchus antarcticus*), a fish of the sub-class *Chimaroidea* or *Holocephali* (q.v.), found in southern seas, where it is the sole representative of its kind. The name alludes to the prominent projecting appendage of the snout. The young remain until an advanced stage of development within the remarkable horny egg-cases, where they are supplied by a current of water which enters and leaves by two pairs of orifices. The fish attains a considerable size and is sometimes eaten in New Zealand.

**Elephant River**, a river of Cape Colony, running into the Atlantic after a course of 140 miles.

**Elephant Seal**, the largest of the eared seals (*Macrorhinus leoninus*), usually over 20 feet long, with a circumference of 12 feet around the thickest part of the chest. The female is much smaller than the male. In color, this seal is grayish; its body is covered with short hair, growing in patches, which gives a spotted look to the animal. The head is proportionately large, with prominent eyes and thick eyebrows; the whiskers are long; and the canine teeth are so large as to form heavy tusks. The nose of the males is prolonged into a proboscis about a foot long, which, seemingly useless, hangs loosely over the face. When this is dilated, it gives a new character to the creature's voice. This species has been almost exterminated, owing to the demand for its oil, though less than a century ago it was plentiful in the southern hemisphere. The skin is not valued for its fur and the flesh is not edible. The herds migrate southward in summer and northward in winter to avoid the extremes of temperature.

**Elephant-shrew**, the typical species *Macroscelides*, of the family *Macroscelididae*, belonging to the order of insect-eating mammals. The body, in general appearance and size, resembles that of the common rat. The popular name alludes to its peculiar, elongated nose, which looks like an elephant's trunk. The hind legs, which are long, and out of all proportion to the length of the fore legs, fit the animal for jumping, giving it the additional name of jumping-shrew. This insect-eater is confined to Africa. It moves by jumps, lives on the sandy plains, makes burrows in the sand, and finds its prey among the grass and bushes.

**Elephanta**, ɛl-ě-făn'tă, or **Elephant Isle**, called by the natives *Gharipur*, a small island in the Bay of Bombay, seven miles northeast of Bombay. It consists of two long hills and an intervening valley. It is celebrated for a cave temple 130 feet long, 123 broad, and 18 high, supported by pillars cut out in the rock. Many of these were cut down by the Portuguese. There are eight pillars or pilasters and in the centre is a gigantic trimurti or three-formed god — Brahma the creator in the middle, with Vishnu the preserver on one side, and Siva the

destroyer on the other. There are other pieces of sculpture, and also several other rock-caves. The date of these constructions is not known. A large stone elephant, which once stood near the landing place, gave name to the island.

**Elephantiasis**, properly speaking, a peculiar and rare disease, sporadic or endemic in warm climates, and characterized by a chronic thickening of the skin and the underlying tissues, usually limited to a definite area, and subsequent to an impairment of the lymphatic circulation. The disease is of great antiquity, and exhibits a great variety of forms, by reason of which it has received a large number of names, medical as well as popular. The term is now applied by the best dermatologists to one disease, and not to several as heretofore. Elephantiasis exists in an endemic form in Africa, India, the Indian Archipelago, the West Indies, and South America. The recent territorial acquisitions of the United States bring this disease in their train. The endemic form of the disease commences rapidly. There is pain, heat, swelling, and temperature. The lymphatics and blood-vessels soon become involved, and the part affected seems to be attacked by erysipelas. In a few days the acute symptoms may subside. A recurrence of the attack leaves the arm, or leg, or scalp, or face, or genitals somewhat thicker, and repeated attacks may result in enormous deformities of the affected parts. In the most characteristic cases of the tropical countries the disease seems to be due to a blood parasite, the *Filaria sanguinis hominis*. This worm gets into the blood, at times through the agencies of mosquito bites, and blocks up the lymphatic channels. In other cases the disease is regarded as a form of chronic erysipelas. In a few instances it is congenital. The treatment will depend largely on the type of the disease. Rest in bed, elevation of the limb, quinine for the *Filaria*, and prompt medical attendance are the essentials. See *FILARIA*; *PARASITES*.

**Elephantine**, ɛl-ə-făn-ti-nē (Arabic, *Djeziret-es-Zaher*, "isle of flowers"), a small island in the Nile, opposite Assouan (Syene), remarkable for the ruins with which it is covered. The island is almost covered with ruins piled up on each other — Egyptian, Roman, Saracen, and Arabic. At the beginning of the present century there were the remains of two temples in Elephantine, one a very interesting one built by Amunoph III. They were destroyed in 1822 by the governor of Assouan in order to obtain stone for building a palace. The greater part of the Nilometer, mentioned by Strabo, which stood at the upper end of the island, shared the same fate. The quay built of blocks taken mostly from older monuments, is from Roman times. Many fragments of pottery with inscriptions in Greek have been found, some of these being receipts for taxes.

**Elephant's-ear**, a name frequently given to plants of the genus *Begonia* (q.v.). It is applied specifically to a Hawaiian plant commonly known as *Caladium esculentum*.

**Elephant's-foot**, or **Hottentot's-bread** (*Tamus* or *Testudinaria elephantipes*), a plant of the yam order (*Dioscoreaceae*), of which the rootstock forms a large fleshy mass, curiously truncate, or somewhat resembling an elephant's foot, and covered with a soft, corky, rough and

## ELEUSINE—ELEVATORS

cracked bark, recalling the shell of a tortoise, whence its other name. From this springs annually a climbing stem, which bears the leaves and flowers, these being small and yellow. The starchy rootstock is used as food by the Hottentots. The plant is not unfrequent in hot-houses. The American plants known as elephant's-foot belong to the genus *Elephantopus* of the *Compositæ*. The genus comprises 14 species, natives of tropical or warm regions. Three are found in the United States, mostly to the south of Delaware. The best known is the Carolina elephant's-foot (*E. carolinianus*). This is an erect hairy herb, with thin oval leaves and bracted heads of blue or purple flowers in branching corymbs. It grows as far north as southern New Jersey, and west to Kansas, and is abundant in all the region to the south. Another species is known in the Southern States as tobacco-weed and devil's grandmother.

**Eleusine**, ĕl-ŭ-sī'nē, a genus of grasses comprising six species, all natives of the Old World. The genus is represented in America by *E. indica*, the crab-grass or yard-grass, which is found in waste places all over North America except in the extreme north, naturalized from Asia. In its native places it is an important article of commerce. *E. corocana*, called in the west of India natchnee, nagia, ragie, and mand, forms a principal article of diet among the hill people of the western Ghauts in India. It is cultivated also in Japan. *E. stricta* is also used for food.

**Eleusinian Mysteries**, festivals held annually at Eleusis, a town of Attica, in honor of the goddess Demeter, or Ceres, the patroness of agriculture, and procreative power of nature. The usual opinion is that they were begun by Eumolpus, the first hierophant, 1376 B.C. Great secrecy was observed in the celebration of the festivals, consisting of the greater and lesser mysteries. The greater mysteries were celebrated toward the end of September and 1 October, lasting nine days. The lesser mysteries took place at Agræ on the Ilissus during spring time. See Walter Pater, 'Greek Studies; Demeter and Proserpina'; Jacob Cooper, 'The Eleusinian Mysteries.' It was a capital offense to reveal any of the rites. They existed about 18 centuries, and ceased during the invasion of Alaric I., in 396.

**Eleusis**, ĕl-lŭ'sis, a ruined village of Attica, but in ancient times a city of Greece, 12 miles from Athens. It was celebrated as the chief seat of the worship of Ceres (Greek Demeter), whose temple here was the largest sacred edifice in Greece. The Greek government began here an elaborate system of excavations in the year 1882, with the result that many remarkable ruins have been discovered. A little village, poor and mean looking, called Leusina, stands on the site of what was once powerful Eleusis. Consult: Diehl, 'Excursions in Greece.'

**Eleuthera**, ĕl-lŭ'thĕ-rā, one of the largest of the Bahama Islands. It is like most of the islands of the group, long and narrow, its length being about 70 miles; area, 234 square miles. Its chief production is pineapples. Its chief town is Governor's Harbor. Pop. 7,200.

**Eleutheria**, ĕl-ŭ-thĕ'rī-ā (Gr. *ελευθερία*, freedom), among the ancient Greeks, a festival commemorative of deliverance from the armies

of Xerxes. It was instituted after the battle of Plataea (479 B.C.), and celebrated annually at that place in the month Maimacterion, nearly corresponding to our September. At the dawn of day a procession marched through the town, at the head of which trumpeters blew the signal for battle. At midday a chariot was driven toward the altar crowned with myrtle and various garlands, and leading behind it a black bull. In front of the altar the archon of Plataea immolated the bull to Jupiter and Mercury, eulogized the heroes who had fallen at Plataea, and sprinkled the ground with wine. Every fifth year these solemnities were attended by contests, chaplets being the reward of the victors.

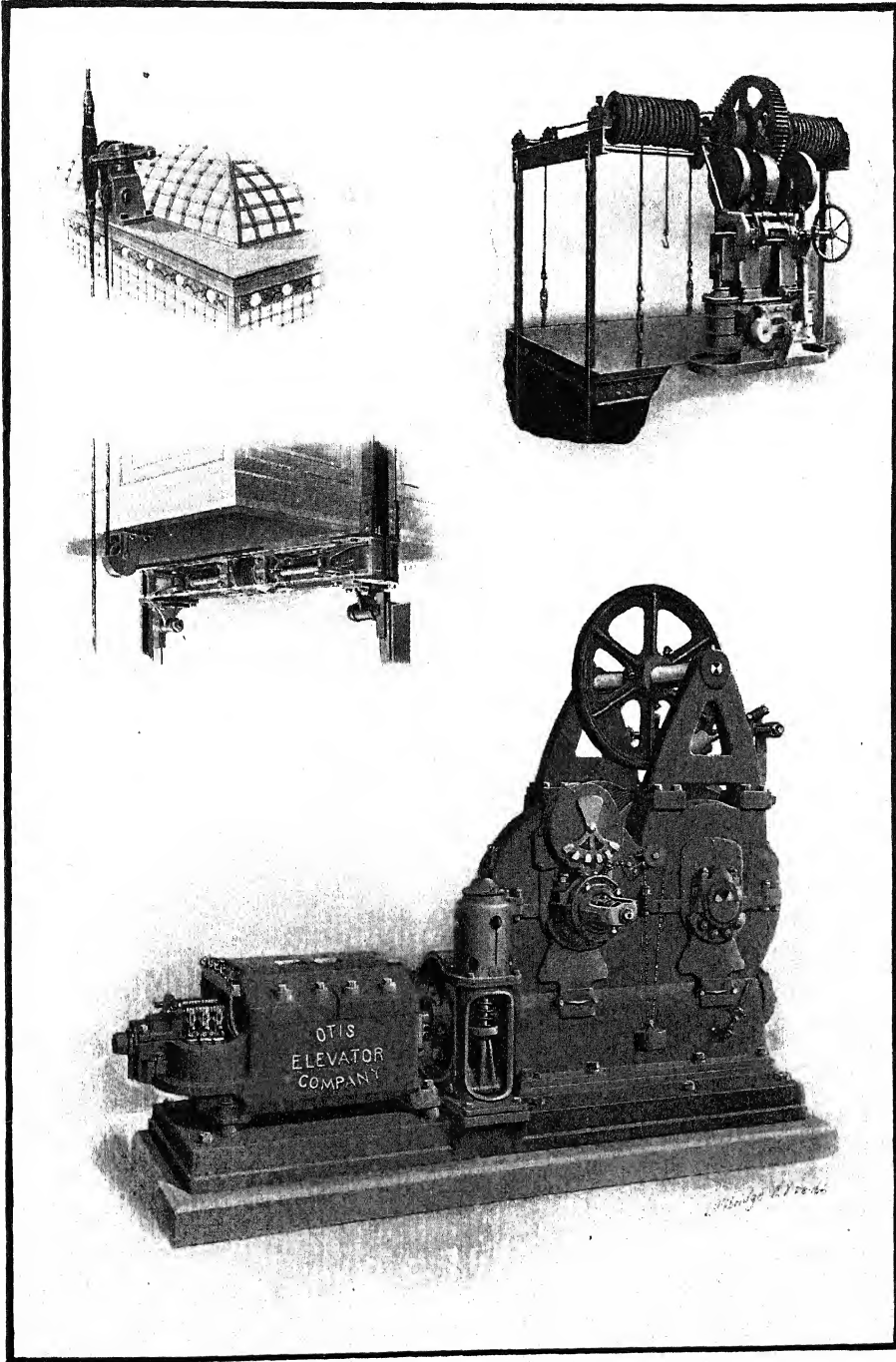
**Eleutheria Bark**, a name for cascarilla bark. See CASCARILLA.

**Elevation**, in the liturgy of the Roman Catholic Church, the act of lifting up by the celebrating priest and presenting to the sight of the faithful, the Host and the Chalice immediately after the consecration; this is the Elevation by eminence. There is both in the Latin and in the Greek Church liturgies another Elevation shortly before the communion. Prior to the promulgation and condemnation of the teaching of Berengarius in the 11th century, the Elevation after consecration appears to have had no place in the Latin liturgy; but from the beginning of the 12th century, when this custom was introduced, it spread rapidly and became universal and obligatory. It was the Church's way of confessing her faith in the truth of transubstantiation attacked by Berengarius. In the Latin Church in the 12th century began, and in the next century became universal, the custom of ringing a small bell at the moment of the Elevation, as is the present usage. But the ringing of the great bells in the church steeples and towers at the Elevation, which was pretty general in the 13th century, is now not common.

**Elevation**, in astronomy and geography, means generally the height above the horizon of an object on the sphere, measured by the arc of a vertical circle through it and the zenith. Thus, the elevation of the equator is the arc of a meridian intercepted between the equator and the horizon of the place. The elevation of the pole is the complement of that of the equator, and is always equal to the latitude of the place. The elevation of a star, or any other point, is similarly its height above the horizon, and is a maximum when the star is on the meridian. In architecture, a geometrical delineation of the front or any face of a building in which all the parts are drawn according to scale and not shown as they would appear in perspective. It is one of the three designs necessary in outlining any work of architecture, the other two being the plan and the section.

**Elevators**. The modern elevator is a direct evolution from the machine which Elisha G. Otis exhibited in 1853 at the World's Fair in the Crystal Palace, New York. Hoists of various kinds had been built before that time, but this was the first elevator wherein provision was made for stopping the fall of the car in the contingency of the breaking of the hoisting cables. During the next five years, a number of machines were built similar to that exhibited, all being driven by belts from line shafting. In 1859 the same inventor introduced an

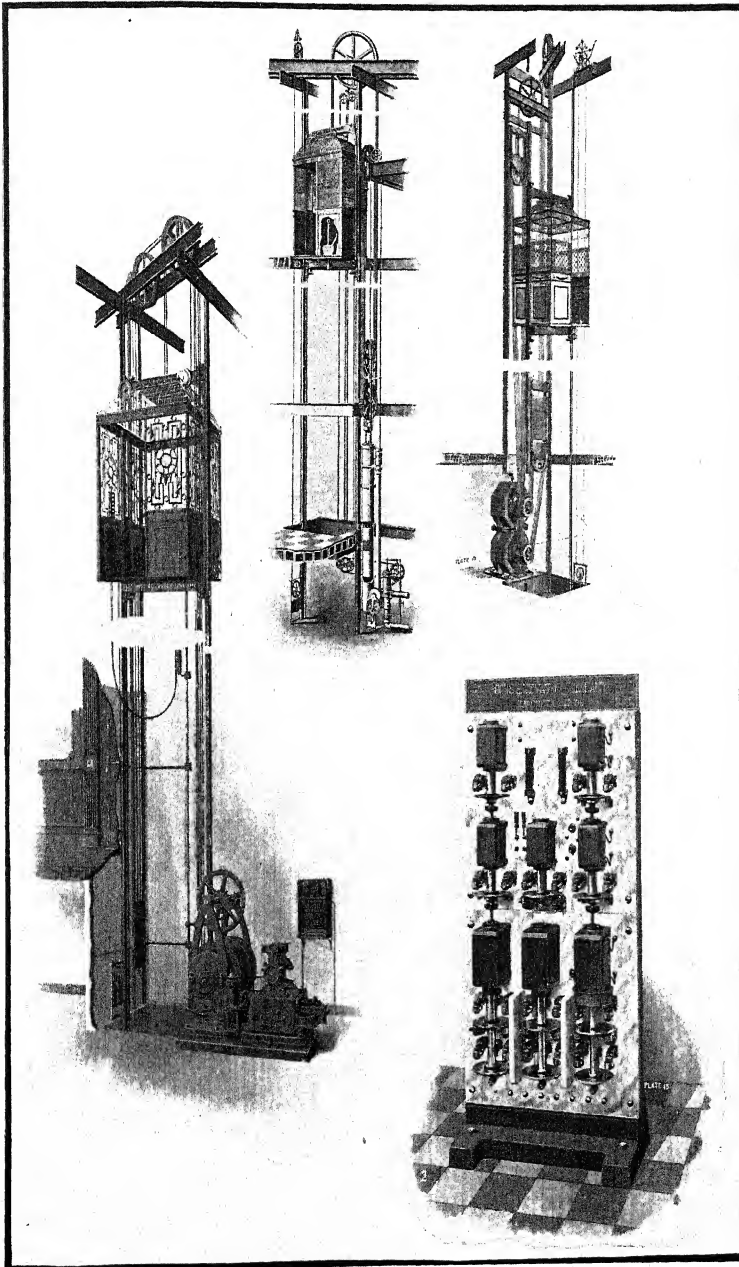
## ELEVATORS.



For explanation, see article.



# ELEVATORS.



For explanation, see article.





## ELEVATORS

independent reversible engine directly connected to the hoisting machinery, and from that date the era of the elevator as a separate institution of the age began. In 1871 the hydraulic elevator was introduced, and thereafter was developed side by side with the steam machine. Finally in 1888, the electric elevator engine was introduced. There are, therefore, four general classes of elevators in use—hydraulic, electric, steam, and belt-driven. The great varieties of conditions encountered in elevator installation and operation has resulted in the development of a number of modifications of each of the four general types.

The type of elevator which is installed in greater numbers than any other is the vertical cylinder hydraulic machine. In this type, a cylinder of a diameter of, say from 8 to 24 inches (according to the water pressure and the load to be lifted), is placed in a vertical position in the elevator shaft or in any other convenient location. Within this cylinder works a piston. Attached to the upper end of the piston rods are the sheaves over which pass the hoisting cables. The length of the cylinder will, of course, depend upon the car travel and on the gearing. (See Fig. 1.) The car here shown is geared 4 to 1, although gears of 6 to 1 and 8 to 1 are quite common. For the ascent of the car, water under pressure admitted above the piston. For the descent of the car the pressure is shut off and the car descends by its unbalanced weight, the water above the piston flowing to the lower part of the cylinder through the pipe at the side known as the circulating pipe. The car is stopped at any desired point by closing a valve which both shuts off the water under pressure and closes up the path through the circulating pipe. Near the top of the circulating pipe is a simple device which limits to a predetermined maximum speed the rate at which water can flow into and out of the cylinder and therefore there is no possibility of the car moving at greater than the maximum speed in either direction.

The desired water pressure is generally obtained by suitable pumps which deliver through a pressure tank which takes up the pump pulsations. The method of controlling the valve from the car may be traced in the illustration. It will be seen that the hydraulic elevator engine is single-acting only—in fact, all styles of hydraulic machines possess this same characteristic, the car descending by its unbalanced weight (except in the pulling plunger type later to be described). It is customary with hydraulic elevators to partially counterbalance the weight of the car, leaving uncounterbalanced only sufficient weight to enable the car to descend at a proper speed.

Continuing the discussion of hydraulic elevators—in certain situations it is desirable to place all of the elevator machinery in the basement, and in such instances the cylinder is placed in a horizontal position. The horizontal cylinder hydraulic engine may be of either the "pushing" pattern wherein the car is raised during the outward stroke of the piston or the "pulling" pattern wherein the work is performed while the piston is being forced inward.

In the design of the modern city building it is highly desirable that as little space as possible be lost for rental purposes and the elevator builders have responded to this requirement (which is continually becoming more urgent) by designing a high pressure machine which is much more compact than any other type of hydraulic elevator. By using a high pressure—700 to 800 pounds per square inch—the size of the entire apparatus including the hydraulic system and pipes can be greatly reduced. The cylinder is suspended in an inverted position so that the plunger, which works therein, on being forced downward causes the car to ascend, as may readily be seen by inspection of the illustration. The high pressure hydraulic engine is also made with horizontal cylinder designed to be placed in the basement. In fact, the horizontal high pressure type is the latest development in elevator engineering. To maintain the pressure necessary for the operation of this system an accumulator of the weighted type is substituted for the pressure tank used in the low pressure systems. The motion of the accumulator governs the pumps, controlling the delivery of water in accordance with the requirements of the service. This is accomplished either by mechanical connections to the steam valves, or by a series of switches when the pumps are driven by electric motors.

The pulling plunger type of hydraulic elevator differs from any other in that when lifting the load it does not consume water, but discharges it from the cylinder. In this elevator the weight of the plunger itself, which is of solid steel, lifts the load, the plunger descending into the cylinder as the car rises in the hatchway. For the descent of the car, the water is admitted at the required pressure under the plunger and, assisted by the weight of the car, raises the plunger and the car descends. The remaining class of hydraulic elevators is the plunger or direct lift type. In this type, a cylinder of a length equal to the car travel is set vertically in the ground. In this cylinder works a plunger of the same length, carrying the car on its top. Water is admitted to and discharged from the cylinder at the top, the annular space around the plunger affording ample passageway for the water. As usual, water under pressure is admitted to the cylinder for the ascent of the car and for the descent is allowed to run out.

*Electric Elevators.*—The construction of a modern electric elevator engine may be described as follows: A motor is connected to suitable winding machinery by means of a worm shaft (a continuation of the armature shaft) engaging with one or two worm wheels, the latter being rigidly connected to the winding drum (in the case of elevators for ordinary freight or passenger service) or connected by means of suitable gearing (for hoists of very large capacities). On the armature shaft and worm shaft a brake wheel is mounted. A brake band is normally held tightly against this wheel by a heavy spring, thus locking the elevator engine. On starting the motor, current is also admitted to a solenoid, the action of which removes the tension from the brake band, allowing a free movement of the motor shaft. On the stop-

## ELF — ELF-ARROWS

ping of the current, the brake is instantly applied by the spring.

Various electric controlling devices have been used with electric elevators. The one most generally used as being the most perfect, operates on the following principle:

On starting the car, the attendant therein moves the lever or switch (as the case may be). This movement admits starting current only to the motor, and thereafter the operations are entirely automatic. As the motor accelerates, the starting resistance is cut out step by step automatically by a series of magnets and thus the current is absolutely prevented from increasing above the amount for which the motor is designed, and a gentle and uniform acceleration is secured. Fig. 2 shows a standard magnet controller for passenger service. In machines of the smaller capacities, there is but a single worm wheel and the end thrust is taken up by ball bearings at the extremity of the worm shaft. In the larger machines, there are two worm wheels, the thrusts of the two compensating each other. Fig. 3 shows a standard electric elevator engine for high-speed passenger service. By proper proportioning of the capacity of the motor and by using a suitable train of gears electric engines may be designed for special, heavy service, and numerous incline railways in various parts of the country for handling teams, passenger cars, and hoists for heavy mine and blast-furnace work, etc., are operated by electric engines working on a principle similar to that above outlined.

The electric elevator with push-button control, is a type designed particularly for private residences. (See Fig. 4.) No attendant is required and the elevator is always ready for service. A passenger desiring to use the elevator presses a button placed near the elevator shaft, and the car, if not in use, immediately travels to that floor and stops automatically. When the car has come to rest at that floor, the door can be opened.

After having entered the car and closed the door, the passenger presses a button corresponding to the floor to which he wishes to travel and the car at once proceeds thereto and the door at that floor can then be opened. After the passenger has left the car, and closed the door, the car may again be summoned from any of the floors as before. In addition to its wide-spread use in private residences, this type of elevator is frequently used in hospitals and apartment houses where it is desired to dispense with an operator.

In the duplex motor electric elevator (Fig. 5) the drum is dispensed with and a sheave is placed on the end of each of the two armature shafts and endless cables pass round these sheaves and are connected to the car and also to the counter-weights by running sheaves. The motors run in opposite directions, and as one or the other of the motors accelerates, the car moves up or down in the hatch-way, its speed being proportional to the difference of speed of the two motors. When both motors are running at the same rate of speed the car is stationary. This type of electric elevator is particularly suitable for the service in which long car travel, fast car speed and rapid reversals are essential features.

Steam machines may be dismissed with simply a reference, as machines of this class are seldom installed now except for freight purposes, having been replaced for passenger service by the newer hydraulic and electric types. In Fig. 6 is shown a new type of steam hoist designed particularly for use on board ships. A marked economy in loading and unloading has resulted in those vessels where these hoists have been installed. The particular hoist illustrated herewith has a capacity of 4,000 pounds net load at a speed of 100 feet per minute, the size of the platform being 7 by 10 feet. Hoists of this character, however, can be made any desired power. The engine can be fitted with an automatic device whereby, at the beginning of a loading operation, the engine is automatically brought to a stop when the platform reaches the lowest deck. When this deck is completely loaded, the device is readjusted to stop the engine automatically, when the platform is lowered to the next deck, and so on. When all the decks are completely loaded, the platform is lowered to the bottom of the hatchway. The main winding drums are then thrown out of gear and the auxiliary hoist, which can be seen in the illustration, becomes operative. The hatchway may then be filled with cargo by means of this auxiliary hoist. In unloading, these operations are, of course, reversed. Belt elevators consist of winding machinery geared to pulleys whereby they may be driven from a counter-shaft. Machines of this type are comparatively inexpensive and are used extensively for freight purposes in factories.

While the factor of safety in the standard make of elevators is such that accidents very rarely occur and practically never where proper attention is paid to the elevator machinery, still all elevators are equipped with standard safety devices. The safety devices consist primarily of a governor of the centrifugal type which is connected to the car entirely independently of the hoisting cables. In the contingency of the car, for any reason, exceeding the speed for which the governor has been set, the governor rope which normally runs freely is tightly clasped and the drum under the car is rotated and the powerful grips such as may be seen in the illustration (Fig. 7) come into play, bringing the car to a safe and easy stop.

THOMAS E. BROWN,  
*Chief Engineer Otis Elevator Co.*

Elf, a little sprite of human form supposed to inhabit wild and desolate places, and to exercise a mysterious power over man; a fairy, a goblin.

Elf-arrows, Elf-bolts, Elf-shot, are the names given to implements of stone, especially flint, of various sizes and forms, which are found abundantly in many countries, and are the remains of arrow-heads, darts, and other rude ancient weapons from the Palæolithic Period. They belong to the same class of ancient implements as are described in our article CELTS (stone hatchets). These rude and ancient implements are objects of some extraordinary superstitions. The names given above are, of

## ELGAR—ELGIN MARBLES

course, of popular and comparatively modern origin, and imply that those who gave them were completely ignorant of the real origin and use of those weapons. These names are found independently among the peasantry in Scotland, England, and Ireland, and the superstitions associated with them are much more widely spread. According to the popular belief the stones are of supernatural origin, and various virtues are attributed to them. They are worn as charms, and used as a protection against lightning; but they are chiefly suspected of mischievous consequences. A cavern has been pointed out where the archfiend carries on the manufacture with the help of attendant imps, who rough-hew them while he finishes the work. Similar superstitions prevail in Italy, Africa, and Turkey. Consult: Evans, 'Ancient Stone Implements of Great Britain.'

**Elgar, Edward William**, English composer: b. Broadheath, Worcestershire. Among his compositions are: 'The Black Knight' (1892); 'Choral Suite: from the Bavarian Highlands' (1895); 'Lux Christi,' produced at the Worcester Festival (1896); 'Te Deum,' sung at the Hereford Festival (1897); 'Caractacus,' produced at the Leeds Festival (1898); 'Sea Pictures,' for the Norwich Festival (1899); 'Dream of Gerontius,' for the Birmingham Festival (1900); 'Coronation Ode' (1902).

**Elgin, El'gin, James Bruce**, 8TH EARL OF, and 12TH EARL OF KINCARDINE, English statesman: b. London 20 July 1811; d. Dhurmsala, North India, 20 Nov. 1863. He was educated at Eton and Oxford; in 1841 entered Parliament as member for Southampton, and in the same year succeeded to the earldom. In 1842 he was appointed governor of Jamaica. His rule in Jamaica was so successful that in 1846 he was appointed governor-general of Canada, and there he succeeded by a conciliatory policy in allaying the discontent which had broken out and for some time continued. In 1849 he was raised to the British peerage as Baron Elgin; was sent in 1857 as special ambassador to China, where in the following year he succeeded in concluding the Treaty of Tientsin. He also concluded a treaty with Japan. In 1860, the Chinese emperor having manifested unfriendliness, Lord Elgin was sent to enforce the treaty, which he did by entering Peking in state and destroying the imperial summer palace. Immediately thereafter, in 1861, he was appointed governor-general of India. He maintained internal peace, and exerted himself unceasingly for the development of the country.

**Elgin, Thomas Bruce.** See BRUCE, THOMAS; ELGIN MARBLES.

**Elgin, Ill.**, a city of Kane County, 36 miles west by north of Chicago. Two railroads supply adequate shipping facilities, the Chicago, M. & St. P., and the Chicago & N. It is also the terminus of the Aurora, Elgin & Chicago Railway, which is a third-rail electric line between these cities, and is the finest road of its kind in existence.

**Industries, etc.**—Two products make Elgin famous—butter and watches. The dairy interests have probably had more to do with the development of the community than any other factor. Early in its history, The Borden Condensed Milk Company located a large plant

here and since that time has established many more in the immediate vicinity. The current quotations of the Elgin Board of Trade fix the market price of high grade butter throughout the entire country. The other industry to which Elgin largely owes its growth and prosperity is the making of fine watch-movements. The watch factory was started in the spring of 1864, and has been a success from the beginning. There are many other industries in Elgin, all of which are prosperous concerns. Two watch-case factories and as many shirt factories distribute their products throughout the country. Besides these, there are shoe, pipe-organ, automobile, coffin-fixtures, canning, malted-milk, and rug factories. Two large publishing houses are located here, and there are several machine shops and foundries.

**Public Institutions, Buildings, etc.**—Elgin is sometimes called the "City of Churches." Nearly all denominations are represented and the various houses of worship are large and handsome. The city is noted for its public school system, which is highly developed and very efficient. The buildings are handsome in architecture and a new high school is in the process of construction. The Elgin Academy of the Northwestern University is a well-known preparatory school for the latter institution, which is located at Evanston, Ill. Saint Mary's Academy is also well known throughout the State and bears a high reputation as a place of learning. The Illinois Northern Hospital for the Insane is located in Elgin. The Elgin Woman's Club has built and now operates a hundred-thousand-dollar hospital, which is famed throughout the country and State for its high standing and great efficiency. Three daily papers are published in the city, the *Daily News* leading in circulation and standing. The banks are six in number, four national and two savings. They have a combined capital of \$650,000 and are prosperous and strong financial institutions.

**History, Government, etc.**—Founded in the spring of 1835, Elgin has grown rapidly in size and importance until it now is the most beautiful and the second largest city in Kane County. Elgin was incorporated in 1854 and Dr. Joseph Tefft was chosen the first mayor. The water-works and sewer system and an electric lighting plant are the property of the municipality and its bonded indebtedness is small. Property is in great demand, owing to the number of Chicago people who, on account of good transportation facilities, are seeking more room and pleasanter homes within the confines of the beautiful city on the Fox. Elgin is growing fast in population and wealth and promises to become one of the best cities in the great State of Illinois.

RICHARD LOWRIE,  
*Of the 'News Advocate.'*

**Elgin Marbles**, the name given to a peerless collection of antique sculptures brought from Athens to England by Thomas Bruce, 7th Earl of Elgin, in the early part of the 19th century. While ambassador at Constantinople (1799-1802) he conceived the plan of securing some portion of the ruins of ancient Athens, and to that end secured permission of the Porte to take "any stones that might appear interesting to him." At his own expense (the British government having refused any aid) he set a corps of artists to work who toiled for 10 years detaching various specimens from the

Parthenon, consisting chiefly of the colossal statues on the tympana of the pediments, the metopes and the frieze around the cella. Among the best preserved examples which this splendid effort brought forth were the tympanum representing the birth of Minerva, the 15 metopes showing in high relief the combats of the Centaurs and Lapithæ and the slabs from the cella frieze depicting in low relief the great Panathenaic procession. In addition to these Lord Elgin procured the colossal statue of Bacchus from the choragic monument of Thrasylus, one of the caryatides from the temple of Pandrosus, a portion of the frieze from the Erechtheum, and fragments of the columns of the Parthenon and Erechtheum; also numerous inscriptions, urns, etc., found in the neighborhood. When these treasures of antiquity arrived on the English shores they were received with a mixture of admiration and indignation—the latter because of supposed vandalism. It is said that Lord Byron was so outraged by the alleged depredations that when he visited the Parthenon he inscribed conspicuously: *Quod non fecerunt Gothi, hoc fecerunt Scoti*. However, as it afterward proved, had not Lord Elgin obtained these sculptures they would have been destroyed in the subsequent war of Greek independence, and especially in the last siege of Athens in 1826-7. After much hesitation, and bickering as to the price, in spite, too, of their value vouched for by experts, the British Parliament purchased the marbles from Lord Elgin for £35,000, easily a third less than he had expended upon them. They are now to be seen in the British Museum as priceless examples of the highest in Greek art which matured under the glorious genius of Phidias. Many casts have been taken of these unsurpassed relics of which the city of New York possesses a set.

**Eli**, ʿēlī, Hebrew judge and high-priest of Israel. After a turbulent rule of 40 years, he died 1116 B.C. Failing to punish the misdoings of his sons, Phineas and Hophnai, the downfall of his house followed.

**Eli Perkins**. See LANDON, MELVILLE, D.

**Eliā**, ʿēlī-ā. See LAMB, CHARLES.

**Elie de Beaumont**, Jean Baptiste Armand Louis Léonce, zhōn bāptēst ār-mān loo-ē lā-ōns ā-lē dē bō-mōn, French geologist: b. Canon, France, 25 Sept. 1798; d. there 22 Sept. 1874. He was educated in the Polytechnic School; became professor at the School of Mines 1829; professor of geology in the College of France 1833; chief engineer of mines 1833; member of the Institute 1835; and perpetual secretary of the Academy of Sciences 1853. He published 'Carte géologique de France' (1843); 'Notices sur les systèmes de montagnes' (1852), etc.

**Eligius**, ʿ-lijj'ūs, or Eloi, ā-lwā. Saint, bishop of Noyon: b. Cadillac, near Limoges, 588; d. Noyon 1 Dec. about 660. Having in boyhood shown a decided aptitude for fine art he was placed by his parents under the direction of the master of the mint at Limoges, and there acquired skill in the goldsmith's craft. Appointed coiner to the Frankish king, Clotaire, and to his son and successor, Dagobert, he executed at their order the bas-reliefs on the tomb of St. Germanus, bishop of Paris, and other works in the precious metals which were re-

garded as the masterpieces of decorative art in that time. He was a favorite at court, which he was obliged to frequent because of his connection with the king; but he took more pleasure in relieving the needy than in the society of the worldly. He daily fed a large number of poor people, he buried the bodies of malefactors, and he ransomed captives, especially the Saxon slaves who were often sold in the markets. Both Clotaire and his son Dagobert bestowed costly presents upon Eligius, but they could not make him rich, he gave so much to the poor and to the founding of charitable institutions. At about the age of 50 he decided to abandon the world entirely and devote himself to the conversion of the pagans. Two years later he was ordained priest and in 546 was made bishop of Noyon. As bishop he gave special attention to the conversion of the Flemings and Frisians, and the greater part of Flanders was converted through his efforts. See Lebeuf, 'Histoire du diocèse de Paris'; Fleury, 'Vita S. Eligius.'

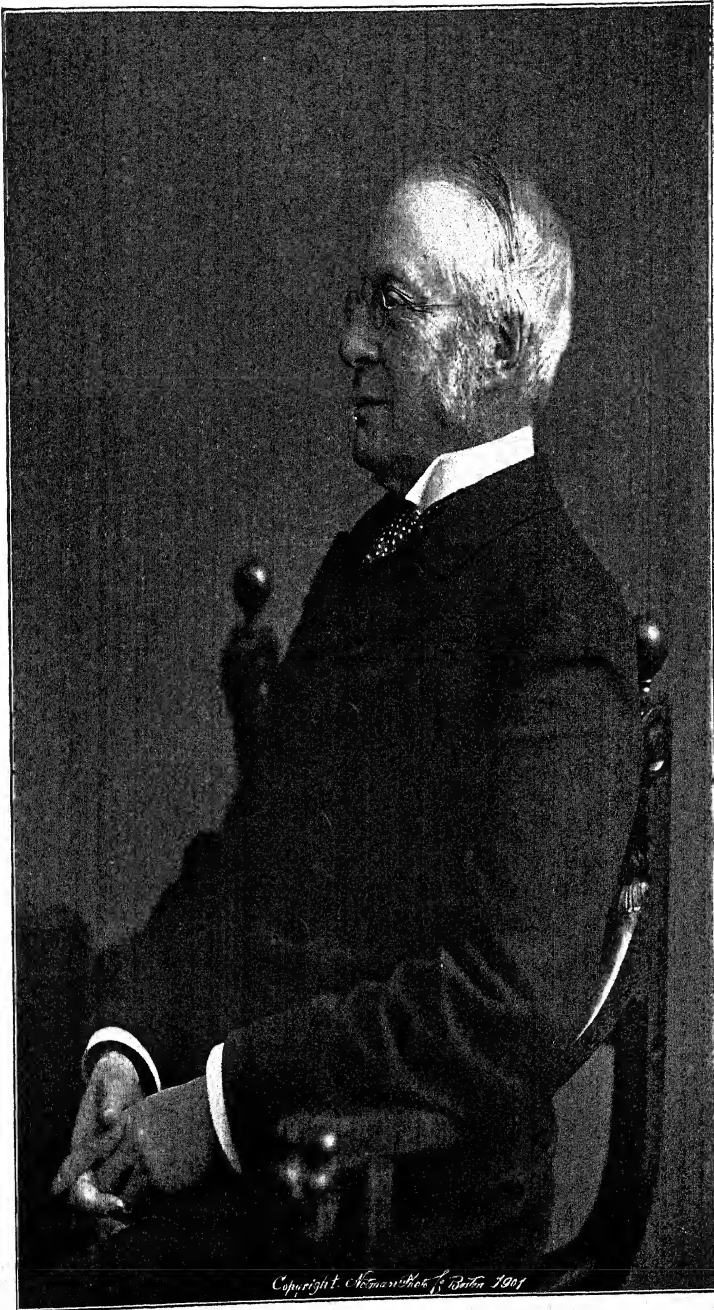
**Eli'jah**, Hebrew prophet. He flourished during the reigns of Ahab and Ahaziah, and until the beginning of the reign of Jehoram. He was especially employed to denounce vengeance on the kings of Israel for their apostasy from the national faith, and many miraculous circumstances are recorded of his life. He incurred the anger of Jezebel, the wife of Ahab, for slaying the prophets of Baal and of the groves at the brook Kishon, and she instigated her husband to put him to death; but Elijah fled to Horeb, where he received a divine manifestation, and afterward returning to Samaria denounced the vengeance of God against Ahab for the murder of Naboth and the usurpation of his vineyard. Elijah was at length taken up to heaven in the presence of Elisha, his successor, who saw him ascend in a chariot of fire (2 Kings ii.). This event occurred, according to Ussher, 896 B.C.

**Elijah**, The, an oratorio by Mendelssohn, first performed at Birmingham, England, 26 Aug. 1846. It is one of his best-known works and is more popular in England and America than any other oratorio, with the exception of Handel's 'Messiah.' The words are taken from the Old Testament.

**Elimina'tion**, the separation and exclusion of some particular substance from a compound, or of some particular symbol from an algebraic expression, thus simplifying the compound or expression, and rendering it capable of further analysis and use. It is a process by which, where we have a number of statements concerning several quantities, we can obtain a separate statement concerning each. Thus, in mathematics, broadly speaking, elimination is the operation which consists in getting rid of a common quantity. See 'Theory of Equations' (1901), Burnside and Panton.

**Eliot**, Charles William, American college president: b. Boston, Mass., 20 March 1834. He was graduated from Harvard in 1853, was tutor in mathematics there 1854-8, and assistant professor of mathematics and chemistry in the Lawrence Scientific School, Harvard, 1858-63. After spending two years in Europe investigating educational methods he was professor of analytical chemistry in the Massachusetts Institute of Technology 1865-9. In the last-named

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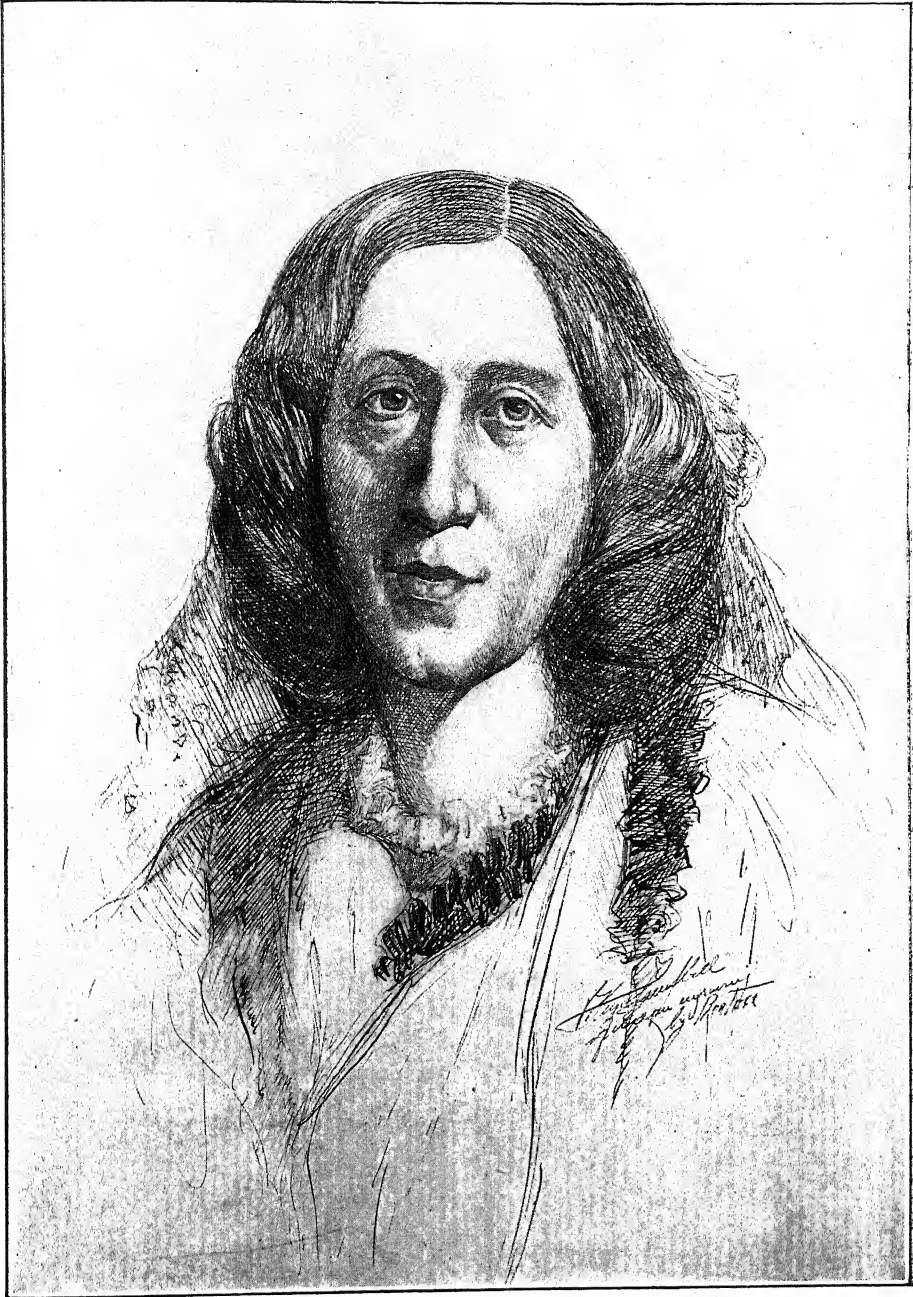
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CHARLES WILLIAM ELIOT,  
President of Harvard University.

\*







*From the etching by Rajon*

GEORGE ELIOT



## ELIOT

year he became president of Harvard University which position he still holds. He is one of the foremost writers and speakers of the day upon educational and social problems and has exerted a strong influence upon the travel of American thought. He has published 'Manual of Qualitative Chemical Analysis' (with F. H. Storer); 'Manual of Inorganic Chemistry' (with F. H. Storer); 'Five American Contributions to Civilization and Other Essays'; 'Educational Reform.'

**Eliot, George** (pseudonym of MARY ANN or MARIAN EVANS CROSS), English novelist: b. Arburyfarm, near Nuneaton, Warwickshire, 22 Nov. 1819; d. Chelsea, England, 22 Dec. 1880. She received her early education at Attleborough, Nuneaton, and Coventry, and sooner or later, either under the tuition of masters or by teaching herself, acquired a knowledge of Greek, Latin, French, German, and Italian; she also studied Hebrew, and for some time devoted herself to the study of music, becoming an excellent piano player. She was also a constant and omnivorous reader. Shortly after her 21st year she came into personal contact with friends who held rationalistic views in regard to religious matters, and though she had previously been attached to the doctrines of the evangelical school (she had an aunt who was a Methodist preacher), her religious views now underwent such a change as to cause a breach between her and her father which seems never to have been entirely closed up. Her first literary undertaking was the continuation of a translation of Strauss' 'Life of Jesus,' commenced by her friend Mrs. Hennell, and completed by Miss Evans in 1846. In 1849 she went abroad, returning to England next year, and in 1851 took up her abode as a boarder in the house of John Chapman, editor of the 'Westminster Review.' This connection led to her being attached to that periodical as sub-editor. Various articles in the 'Review' from 1852 onward have been attributed to her, but her principal work appears to have been the writing of the summaries of contemporary literature. It was not, however, until January 1857 that she came prominently into public notice, when the first of a series of tales entitled 'Scenes from Clerical Life' appeared in 'Blackwood's Magazine.' These tales immediately arrested attention, and obtained the praise of the editor, who was informed that he was to know the author as George Eliot. Mr. John Blackwood was as ignorant of the author's identity for a considerable time as was all the world except George H. Lewes (q.v.), and one or two others. The 'Scenes' came to an end in November 1857, and in the February following, the first chapters of 'Adam Bede' were in the publisher's hands, the whole work being completed and sent in by October. The success which attended the publication of this powerful story of English rural life was unmistakable, and public curiosity was greatly excited as to the personality of the author. The credit of authorship was openly ascribed to various persons of more or less note and was claimed by others of more or less modesty and honesty. The secret soon began to leak out. Months before her second novel, 'The Mill on the Floss,' was published (1860) it was well known, among literary circles at least, that George Eliot was none other

than Marian Evans, the Westminster reviewer. By this time was established that close association and literary fellowship with the talented philosophical writer, George H. Lewes, which terminated only with the death of the latter but a little more than two years before her own. In 1861 was published 'Silas Marner,' another story of humble country life, a painful, but powerful and interesting tale. Two years later she gave to the world 'Romola,' an historical novel of Italian life in the time of Savonarola, which is considered by a select few as her greatest intellectual achievement. This was followed by 'Felix Holt,' a story dealing with political, social, and religious peculiarities (1866); 'Middlemarch,' somewhat weak and diffuse as a story, but replete with pregnant thought and clear delineation of character (1871); and 'Daniel Deronda,' containing some striking and original sketches of Jewish life and character (1876). Previous to this she had acquired some renown as a poet through the publication of several volumes of poems, among which may be mentioned: 'The Spanish Gypsy' (1868); 'Agatha' (1869); and 'The Legend of Jubal' (1874). Her last work was a series of essays, entitled the 'Impressions of Theophrastus Such' (1879). In May 1880 she married Mr. John Cross, but died rather suddenly at Chelsea on 22 December of that year. Her 'Life, as Unfolded in Her Letters and Journals,' was published in 1885 by her husband. See also: Dowden, 'Studies in Literature' (1878); Blinde, 'George Eliot' (1883); James, 'Partial Portraits' (1888); Parkinson, 'Scenes from the George Eliot Country' (1888); Stephens, 'George Eliot' (1892); Myers, 'Essays Modern' (1883); Hutton, 'Modern Guides of English Thought' (1887).

**Eliot, Jared**, American Congregational clergyman: b. 7 Nov. 1685; d. 22 April 1763. He was a grandson of John Eliot, the "Apostle to the Indians," and was long pastor at Killingworth, Conn. He was an able preacher, a botanist, and a scientific and practical agriculturist, was the first to introduce the white mulberry tree into Connecticut, and discovered a process of extracting iron from ferruginous sands. He was also regarded as the first physician of his day in the colony; and such was his success in the treatment of insanity and chronic complaints, that he was sometimes sent for to Newport and Boston, and was more extensively consulted than any other physician in New England.

**Eliot, Sir John**, English orator and statesman: b. Port Eliot, Cornwall, 20 April 1592; d. London 27 Nov. 1632. He entered Parliament in 1614 as member for St. Germans, winning immediate reputation as an orator. As vice-admiral of Devon he was energetic in suppressing piracy. In the three parliaments of 1623, 1625, 1626, he made his way to the front of the Constitutional party, joined Hampden and the rest in refusing contributions to the forced loan, and took a prominent share in the impeachment of Buckingham and in drawing up the 'Remonstrance and Petition of Right.' He was imprisoned in the Tower in 1629, and died there three years later. During his imprisonment he wrote a work on constitutional monarchy, entitled the 'Monarchy of Man,' and

several other works, including an account of the first Parliament of Charles I. under the title 'Negotium Posteriorum'; a vindication of his public conduct, entitled 'An Apology for Socrates'; and 'De Jure Majestatis,' a treatise on government. Eliot was not a Republican, but believed in constitutional monarchy, and all through his career boldly maintained the privileges of Parliament both in its individual members and as a legislative and executive body. See 'Life' by Forster (2d ed. 1871).

**Eliot, John**, American colonial missionary, "the Indian Apostle": b. probably at Widford, Hertfordshire, 1604; d. Roxbury, Mass., 21 May 1690. He was graduated at Cambridge in 1622, and, after taking orders in the Church of England, quitted his native country for conscience's sake, and landed at Boston, New England, in 1631. In 1646, after two years' study of the Indian language, he delivered a long sermon in the native dialect at Nonantum, and other meetings soon followed. He shortly after began to establish his converts in regular settlements, his work meeting with approval both in the colony and at home; in England a corporation was founded in 1649 "for the promoting and propagating the Gospel among the Indians of New England," which defrayed the expenses of the preachers and the cost of printing translations. At one time there were over a dozen townships of "praying Indians" within the bounds of Massachusetts, and many more outside these limits, with numbers estimated in 1674 at 3,600; but, although the organization survived until the death of the last native pastor in 1716, the decay of the "praying towns" was rapid after the war with King Philip (1675), in which the converts suffered equal cruelties at the hands of their countrymen and of the English. There are monuments to Eliot's memory in the Indian burying-ground at South Natick, and at Newton, near the scene of his first Indian sermon. A man of earnest piety and devotion, warm-hearted, and of a singularly attractive manner, he has left a memory that is honored among the first in the history of New England. With Thomas Weld, and Richard Mather, Eliot prepared an English metrical version of the Psalms, the 'Bay Psalm-book' (Camb. 1640), as the first book printed in New England. He was also the author, among other works, of: 'The Christian Commonwealth' (Lond. 1659), suppressed by the general court, and now extremely rare; 'The Communion of Churches' (1665), the first book privately printed in America; and of translations into the Indian tongue of Baxter's 'Call'; Bayly's 'Practice of Piety' (abridged); and Shepard's 'Sincere Convert.' But the great work of his life was the translation of the Bible into the tongue of the Indians of Massachusetts (Algonquin), of which the New Testament appeared in 1661, and the whole work, with a version of the Psalms in metre, and a page of "catechism" in 1663. The longest single word in it is "Wutappesittuk-qussunnoohwehtunkquoh," signifying "kneeling down to him," in Mark i. 40; which illustrates the jest of Cotton Mather, who said he thought the words of the language must have been growing ever since the dispersion at Babel. Only 14 complete copies of the first and second editions are known to be in existence. A scientific study

of Eliot's Indian Bible was made by J. H. Trumbull (q.v.), and his MS. published 1903 as 'Bulletin 25' by the Bureau of American Ethnology, Washington. Its title is the 'Natick Dictionary,' and it is divided into two parts, the first giving the Natick words with English definitions and the second giving the English words with Natick definitions. In other words, the volume contains two dictionaries, one Natick-English and the other English-Natick. While it is devoted to the Natick language it is practically a dictionary of all the Algonquin languages of Massachusetts, for the tribes of that part of the country spoke practically the same language, though each had its dialectic variations. Eliot's 'Indian Grammar Begun' was printed in 1666; his 'Indian Primer' in 1669. The finest collection of unique and scarce copies of Eliot's works is in the Lenox Library, New York; many of them have been reprinted. The best 'Life of Eliot' is that by Francis in Volume V. of the first series of Sparks' 'American Biography' (1836); the earliest that by Cotton Mather 1691; consult also articles in the 'Cyclopædia of American Biography' (Vol. II. 1887); and the 'Dictionary of National Biography' (Vol. XVII. 1889).

**Eliot, Samuel**, American educator and historian: b. Boston, Mass., 22 Dec. 1821; d. Beverly, Mass., 14 Sept. 1898. He filled the chair of history and political science in Trinity College, Hartford, Conn., 1856-64; was president of Trinity College 1860-4; and overseer of Harvard 1866-72. Among his publications are: 'The History of Liberty' (1853); 'The Liberty of Rome' (1849); 'Life and Times of Savonarola' (1856); 'Manual of United States History Between the Years 1492 and 1850' (revised ed. 1873); and 'Stories from the Arabian Nights' (1879).

**Eliot, Samuel Atkins**, American Unitarian minister: b. Cambridge, Mass., 24 Aug. 1862. He was graduated at Harvard College 1884; was pastor of Unity Church, Denver, 1889-93, and of the Church of the Saviour, Brooklyn, 1893-8. He was secretary of the American Unitarian Association 1898-1900, becoming its president at the latter date.

**Elis, e'lis**, (1) A country in the west of Peloponnesus, where Olympia was situated. It was bounded on the east by Arcadia, on the south by Messenia, and ran along the coast, watered by the river Alpheus. Elis and Achaia now form a monarchy of Greece. (2) Elis, the capital of Elis, is now called Kaloskopi. See OLYMPIA; OLYMPIC GAMES. Consult: Curtius, 'History of Greece.'

**Elise, or San Antonio, Colony, Paraguay**, an agricultural settlement started in 1890, situated in the department of San Lorenzo de la Frontera, on the left bank of the Paraguay River, about nine miles from Asunción. Products: tobacco, sugarcane, coffee, ramie grass, etc. See PARAGUAY.

**Eli'sha**, a Hebrew prophet, the disciple and successor of Elijah. Many miracles of prediction and cure, and even of raising the dead, are ascribed to him. He held the office of prophet for fully 65 years, from the reign of Ahab to that of Joash (latter half of the 9th

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century B.C.). Consult: Bible, 1, 2 and 3 Kings.

**Elixirs**, in pharmacy, are aromatic, sweetish, spirituous preparations, containing small quantities of active medicinal drugs. They are now mostly used as vehicles, and have very little potent action save that of the alcohol which they contain. Elixir aromaticum and Elixir phosphorus are the only two elixirs sanctioned by the 1890 revision of the United States Pharmacopœia.

**Elizabetgrad**, ě-lē-zā-bět-grād', or **Yelisetgrad**, Russia, fortified town, in the government and 130 miles northwest of Kherson, in a plain on the Ingul. It consists of the town proper, built with the greatest regularity in spacious streets, occasionally lined with trees; of four suburbs, and of the citadel, surrounded by six bastions. The military colonies of the district have their headquarters here. Pop. 61,841.

**Elizabeth**, the wife of Zacharias and mother of John the Baptist. An angel foretold to her husband the birth of a son to her old age; and it was also foretold by the angel Gabriel to the Virgin Mary, as an assurance of the birth of the Messiah.

**Elizabeth, Saint**, of Hungary, daughter of Andrew II., king of Hungary, and Gertrude, daughter of the Duke of Carinthia: b. Presburg 1207; d. Marburg 19 Nov. 1231. Early in life she displayed a dislike for things worldly, as the pomp with which she was surrounded, ambition, avarice, and vain pleasures, and began to cultivate humility, piety, and great charity. According to the custom of the times, when she was only four years old she was betrothed by her parents to Louis, the son of the landgrave of Thuringia, who was about her own age. When Elizabeth was 14 years old they were married. Her husband admired his wife's piety and approved her great charity, especially during the famine in Germany in 1225, although members of his own family severely censured her. She founded hospitals in Marburg and other places within her husband's dominion. (Louis' father died the year after the betrothal, and he was the landgrave when he married Elizabeth.)

In 1227 Louis left home with Frederick Barbarossa to engage in the war for Palestine; but before reaching the Holy Land Louis died from fever. Great misfortunes soon befell Elizabeth. She was deprived of her regency by the brother of her deceased husband, and driven out of her dominion on the plea that she wasted the treasures of the state by her charities. The inhabitants of Marburg, whose miseries she had frequently relieved, refused her any asylum, for fear of the new regent. At last she found refuge in the monastery of Kitzingen, where her aunt was abbess, and later with her uncle, bishop of Bamberg, and when the warriors who had attended her husband in the Crusade returned from the East with his body, she gathered them around her, and recounted her sufferings and the wrongs done to her three children. Steps were taken to restore to her her sovereign rights. She declined the regency, however, and would accept only the revenues which accrued to her as landgravine. The remainder of her days were devoted to almsgiving, morti-

fications, and prayer. She became a member of the Third Order of Saint Francis, and in pictures she is often represented clothed in the Franciscan habit. She was canonized by Gregory IX. four years after her death. Consult: Montalembert, 'Life of Saint Elizabeth of Hungary'; Starr, 'Patron Saints'; Butler, 'Lives of Saints'; Bonaventure, 'Sermon on St. Elizabeth'; Theodoric, and Montague of Spire. There are extant manuscripts on her life, by contemporaries, Conrad of Marburg, Siegfried of Mentz, and others.

**Elizabeth**, queen of England: b. Greenwich 7 Sept. 1533; d. Richmond, Surrey, 24 March 1603. She was the daughter of Henry VIII. and of Anne Boleyn. After her mother had been beheaded (1536) both she and her sister Mary were declared bastards, but finally she was placed after Prince Edward and the Lady Mary in the order of succession. Thus, while the first two marriages of King Henry were both still held to be illegal, the children of both were legitimized. Elizabeth received a classical education, as was customary with women of rank in her time, and under her tutor, Roger Ascham, is said to have attained very considerable proficiency in Latin and Greek. During her father's life, as well as in the reign of her brother, various negotiations were entered into for her marriage. The Duke of d'Angoulême and Philip of Spain, who afterward married her sister, were among the matches proposed for her; but the only affair of this kind in which she may be supposed to have been personally interested was the suit of Lord Seymour of Dudley, the Protector Somerset's brother. It is certain that even during the life of Catharine Parr, the widow of Henry VIII., whom he married, his attentions to the Lady Elizabeth were only too well encouraged. Both before this marriage and after the death of his wife he was a suitor for the hand of the princess; but his ambitious designs in this and other matters were not countenanced by the council, and ultimately cost him his life.

On the death of King Edward Elizabeth vigorously supported the title of Queen Mary against the pretensions of Lady Jane Grey, by which her own title as well as her sister's were barred. She rode to meet her sister, accompanied by 1,000 horse, and this bold proceeding was of no small service in confirming the doubtful in their allegiance; but Elizabeth gained little for herself by a policy in which it was well understood she had her own interest in view. After Wyatt's conspiracy her life was in great danger, and was probably saved only by the intercession of Philip. She was committed to the Tower, from whence she was removed to Woodstock, where she was confined with great strictness. She afterward, through Philip's intercession, obtained greater liberty; but throughout the whole reign continued an object of suspicion and surveillance. The danger she now incurred developed a trait in her character which ever after continued conspicuous, her power of dissimulation. She made every demonstration not only of conformity, but of zealous adherence to the established religion. Her conduct in this must not be judged from the point of view of rigid Protestantism, which Elizabeth never professed; but there were some at least among the

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Roman Catholic ceremonies and customs to which she could not be supposed to give a sincere adherence. Nevertheless, her false zeal must have been well and ably sustained, for her conduct was not left to the report of friends, but carefully watched by spies and informers. Philip was most anxious to have her married out of the kingdom; and if the Duke of Savoy, whom he proposed, was unacceptable from his Roman Catholicism, there was Eric, son of the king of Sweden, who long after continued to press his suit; but Elizabeth refused both. She felt in herself a capacity for rule, and her sister's ill health opened up for her an early prospect of the throne, which she was unwilling to peril. Mary's reign was not without advantage to Elizabeth. It tried her councilors as well as herself, and gave her the opportunity of selecting them to advantage. Her adviser throughout the whole of it was William Cecil, afterward Lord Burleigh, who had already been a minister under Edward VI., and continued for the rest of his life to be one of the chief councilors and ablest ministers of Elizabeth, to whom he was in many respects a congenial spirit.

On 17 Nov. 1558 Mary's disastrous reign came to a close, and Elizabeth was immediately recognized queen by Parliament. On entering London she was met by the bishops, whom she permitted to kiss her hand, with the exception of Bonner, "whom she omitted for sundry severities in the time of his authority." It was now that the caution and secrecy characteristic equally of Elizabeth and Cecil, and which enabled them to do such great things, appeared in spontaneous exercise. The Roman Catholic religion was still predominant in the House of Lords, and any attempt to overthrow it suddenly might have been attended with the greatest danger. Elizabeth made no immediate change in her habits. For a full month the ceremonies of the Roman Catholic Church were retained in all their state. A solemn funeral service was held for Queen Mary in Westminster Abbey, at her interment on 13 December. The queen even intimated her accession to the Pope. She retained the greater part of her sister's council, choosing only seven new councilors, who were Protestants, it is true, but not then known as such. Like Cecil and herself, they had all conformed, and possessed the necessary qualification for Elizabethan councilors of accomplished hypocrisy. Such were her difficulties, notwithstanding her great prudence, that at her coronation only one of all the bishops, Oglethorpe of Carlisle, could be found to set the crown on her head. The obstacle, it is said, was her refusal to permit the elevation of the host. She had also before this authorized the reading of the liturgy in English. The first great object of her reign was the settlement of religion. A Parliament was immediately called, to which this work was assigned. It met on 25 January, and was dissolved 8 May, but its object was already accomplished. The nation was prepared for a return to the reformed faith, and the Parliament was at the bidding of the court. The reformation of religion in England was the work of Cranmer, and had already been accomplished in the reign of Edward VI.; the re-establishment of the ecclesiastical system of the national Church on the basis on which it has remained to the present day was the work of

Cecil and Elizabeth, and it was nearly completed in this Parliament. Elizabeth had less extreme opinions than many supporters of the new faith. She was tolerant, for instance, in regard to images, and is said to have entertained scruples as to the extent of the royal supremacy in spiritual matters; but if she did, they must have been purely speculative. They certainly vanished on the first taste of power.

If the formal establishment of the reformed religion was easily completed, the security and defense of the settlement was the main object of the policy and the chief source of all the struggles and contentions of her reign. What made the position so difficult was the intolerance by which at this period and for long after all religious sects were characterized. No sooner were the Puritans freed from the restrictive measures of Mary's reign than they began to claim predominance for their own dogmas. But it was far from the intention of the queen and the supporters of the Established Church, notwithstanding the common persecutions they had endured, to grant them even liberty of worship. Elizabeth's own determination, as expressed by herself, was that none should be allowed to turn aside either to the right hand or the left from the drawn line of prescribed duty, and in insisting upon uniformity of worship she was not singular, but was acting in the spirit of her age. This principle was not less firmly held in her reign than in her sister's; and Roman Catholics on the one hand, and Puritans on the other, restrained only by their dread and hatred of each other, were made the irreconcilable enemies of the existing order. Moreover, from the necessities of the struggle the severities of Elizabeth's reign went on increasing as time advanced. At first no one suffered death for his opinions; but eventually many were executed for this cause. The struggle against Roman Catholics was the most severe, chiefly because they were supported by foreign powers; so that while their religion was wholly prohibited, even exile was forbidden them in order to prevent their intrigues abroad. Simple non-conformity, from whatever cause, was pursued with the severest penalties. The fine imposed for non-attendance at church was £20 per month, while so strait were the lines of conformity drawn, that many more clergymen were driven out of the Church by differences about the position of altars, the wearing of caps, and such like matters, than were forced to resign by the change from Rome to Reformation. These stringent measures were, however, the rigid consequences of the false position assumed.

Elizabeth's first Parliament approached her on a subject which, next to religion, was the chief trouble of her reign, the succession to the crown; they requested her to marry. She replied in a long speech, declaring her intention to live and die a virgin. It is certain, from her conduct both before and after, that this declaration was only a convenient affectation of prudery, which at once served to flatter her vanity and to veil her real indecision. She saw too clearly for her own interest the restraints to which each particular marriage might subject her, and therefore, she shunned them all, thus leaving open the question of the succession.

On Elizabeth's accession the country was at war with France. Peace was easily concluded



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1559; but the assumption by Francis and Mary of the royal arms and titles of England led to an immediate interference on the part of Elizabeth in the affairs of Scotland. She entered into a league with the Lords of the Congregation, or leaders of the Reformed party; and throughout her reign this party became distinctively an English one, and was frequently serviceable in furthering her policy. She also gave early support to the Huguenot party in France, and to the Protestants in the Netherlands, so that throughout Europe she was looked on as the head of the Protestant party. This policy roused the implacable resentment of Philip, who strove in turn to excite the Roman Catholics against her, both in her own dominions and in Scotland. After the detention of Mary queen of Scots in England, he fomented the various rebellions in her favor formed in England and Ireland, and at her death declared himself her avenger. Mary, as is well known, was imprisoned 19 years in England, whither she fled to the protection of Elizabeth. Her imprisonment was followed by a series of conspiracies, beginning with that under the earls of Northumberland and Westmoreland, and ending with the plot of Babington, which finally determined Elizabeth to make away with her captive. The execution of Queen Mary was, nevertheless, the chief political blunder of Elizabeth's reign. If the death of Mary did not raise up new enemies to Elizabeth on the continent it at least gave a just cause of scandal to those she already had. Elizabeth had for some time been engaged in a negotiation for marriage with the Duke of d'Alençon (afterward d'Anjou); and in 1580 the Duke arrived in London to pursue his suit, which had lasted nearly 10 years, in person. He was well received, but still the queen hesitated. She was now 47. The following winter the Duke paid another visit, and the marriage was all but concluded, but she finally informed him she could never marry.

The state of France, as indicated by the change of government consequent on the accession of Henry IV., who was assisted by Elizabeth, obviated any danger that might have arisen from the indignation which the execution of Queen Mary had caused in that country. Nowhere, however, was that event more meekly borne than by King James. The Scottish Solomon had thought his mother's danger a favorable opportunity for sententious observations about the strangeness of her case, and now his philosophy was nonplussed. His awe of Elizabeth and his dread of interfering with his own right of succession to England made him powerless, and he accepted an addition to his pension in full of all grievances. Philip was not to be so appeased. He had other grievances, to which the execution of Mary lent edge. The fleets of Elizabeth had galled him in the West Indies, her arms and subsidies had helped to deprive him of the Netherlands; the Armada was already in preparation. Therefore he called the queen of England a murderess, and refused to be satisfied even with the sacrifice she seemed prepared to make of her Dutch allies. The Armada sailed on 29 May 1588. Its fate is too well known to need recapitulation. The war with Spain dragged on till the close of Elizabeth's reign.

During her long rule Elizabeth showed her

judgment in nothing so much as in the councilors she trusted. But while the splendor of her government at home and abroad was sustained by such men as Burleigh, Bacon, Walsingham, Throgmorton, and Davison, who served her with a zeal which did not always spare even their own reputations, she had personal favorites of less merit who were often more brilliantly rewarded. It is sufficient to name Dudley, whom she created Earl of Leicester; and Essex, who was still more a personal favorite, though much less a courtier. The latter had some merit as a soldier; but his violent temper, ill-suited to the queen's haughty disposition, brought about his ruin. He was beheaded in 1601, and Elizabeth never forgave herself his death. Her own health soon after gave way, and she died, naming James of Scotland as her successor.

Besides its political glories, the reign of Elizabeth was the golden age of English literature. If all else could be forgotten, it would be remembered as the age of Spenser and of Shakespeare, not to mention a host of minor names. The naval achievements of Drake and the discoveries of Raleigh concurred to do it honor. Thus everything conspired to throw a halo round the name of Elizabeth, when regarded as a sovereign, and seen as she would be in her own day, especially by foreign beholders, through the drapery of state. If a minute criticism has exposed some of the weakness of the individual woman who bore this burden, it must be remembered that the process is only half fair. As a sovereign she is entitled to her surroundings, and as an absolute ruler, as to a great extent she undoubtedly was, she must have her share of praise for the good that was done in her name. It is no small merit to select good councilors and to adhere to them. Elizabeth knew how to do both; and yet she was no puppet in the hands of her advisers. Though haughty and imperious to the Commons, she knew both when and how to yield. She studied with rare sagacity the temper of the people; and high as were her notions of prerogative, she may fairly be considered the first constitutional monarch of England.

*Bibliography.*—Camden, 'History of Queen Elizabeth' (1622); D'Ewes, 'Journals of all the Parliaments of the Reign of Queen Elizabeth' (1682); Bruce (ed.), 'Letters of Elizabeth and James VI.' (1849); Wright, 'Queen Elizabeth and Her Times' (1838); Strickland, 'Lives of the Queens of England'; Wiesener, 'La jeunesse d'Elizabeth d'Angleterre' (1878); Froude, 'History of England' (Vols. VII.-XII. 1870); Martin Hume, 'Calendar of Spanish State Papers: Elizabeth'; *ibid.* 'Courtships of Queen Elizabeth' (1896); *ibid.* 'The Year After the Armada' (1896); *ibid.* 'The Great Lord Burghley' (1898); Creighton, 'Queen Elizabeth' (1899); Jessop, 'Queen Elizabeth,' in 'Dictionary of National Biography.'

**Elizabeth**, empress of Austria: b. Possenhofen, Bavaria, 24 Dec. 1837; d. Geneva 10 Sept. 1898. She was the daughter of Duke Maximilian Josef of Bavaria, and married her cousin, the Emperor Franz Josef on 24 April 1854. Together they were crowned with the insignia of St. Stephen when the inauguration of the dual system was solemnized. She was greatly admired by Austrians and Hungarians alike.

## ELIZABETH FARNESE — ELIZABETH CITY

While visiting Geneva, Switzerland, she was assassinated by an Italian anarchist.

**Elizabeth Farnese**, fär-nä'zë, queen of Spain: b. 25 Oct. 1692; d. 1766. She was a daughter of Edward II., Prince of Parma. On becoming the second wife of Philip V. she surprised those who had counseled the marriage by assuming the practical headship of the kingdom; her ambition and that of her minister, Alberoni, disturbed the whole of Europe.

**Elizabeth, Madame** (ELISABETH PHILIPPINE MARIE HÉLÈNE), French princess: b. Versailles 3 May 1764; d. Paris 10 May 1794. She was a sister of Louis XVI. She was the faithful friend and companion of the royal family in their flight to Varennes, and during their imprisonment was executed, on the pretense of corresponding with her other brothers, afterward Louis XVIII. and Charles X.

**Elizabeth, Pauline Ottilie Luise**, queen of Rumania (pseudonym "CARMEN SYLVA"): b. Neuvièd 29 Dec. 1843. She married Charles of Rumania, 15 Nov. 1869. She is well known as a writer over the signature "CARMEN SYLVA," her works including 'Sappho' (1880); 'Hammerstein' (1880); 'Stürme' (1881); 'Leidens Erdengang' ('Sorrow on Earth') (1882); 'Les pensées d'une reine' (1882); 'Pelesch Märchen' (1883); 'Le pic aux regrets' (1884); 'Es klopf' (1887); etc.

**Elizabeth Petrov'na**, empress of Russia: b. 29 Dec. 1709; d. 5 Jan. 1762. She was the daughter of Peter the Great and Catharine, and ascended the throne on 7 Dec. 1741, as the result of a conspiracy, in which Ivan VI., a minor, who had reigned only one year, was deposed. Elizabeth is said to have rivaled her mother in beauty, and to have surpassed her in her love of pleasure. Her reign was stained both by her unbridled licentiousness and the tyranny of her government, which was conducted by favorites. Banishment to the mines of Siberia and imprisonment in dungeons were awarded for the slightest political offenses. She was a patron of literature, and corresponded with Voltaire, to whom she supplied materials for his 'Life of Peter the Great.' She also founded the University of Moscow and the Academy of Fine Arts of St. Petersburg. Elizabeth sent an army, in 1748, to assist Maria Theresa in the war of the Succession, which contributed to bring about the Peace of Aix-la-Chapelle; and she joined in the Seven Years' war against Prussia.

**Elizabeth Stuart**, queen of Bohemia: b. Falkland Palace, Fifeshire, 16 Aug. 1596; d. London 13 Feb. 1662. She was a daughter of James I. of England, and was married to the Palatine Frederick at Whitehall, 14 Feb. 1613. Her husband was then at the head of the Protestant interest in Germany, and in 1619 he accepted the crown of Bohemia offered to him by the revolted Protestants of that country. This he was only able to retain for a very short period; and after his defeat by the Imperialists at the battle of Prague in 1620, he and his wife were obliged to flee, first to Breslau and Berlin, and then to The Hague. Elizabeth had 13 children, several of whom died early. Charles Louis, the eldest surviving, was reinstated in the palatinate by the Treaty of Westphalia in 1648. His daughter, Elizabeth Charlotte, was

the second wife of Philip, Duke of Orleans, brother of Louis XIV. Her descendants were excluded by their Catholicism from the crown of England, but one of them was regent of France during the minority of Louis XV.; and another, Louis Philippe, ascended the throne after the revolution of 1830. Her sons, Princes Rupert and Maurice, distinguished themselves in the civil war in England. Her daughter, Sophia, married into the house of Brunswick, became electress of Hanover, and mother of George I. Elizabeth Stuart's cause was extremely popular with the English nation, and after her husband was deprived of the crown of Bohemia she still retained among them the endearing epithet of "Queen of Hearts." She returned to England at the Restoration with her nephew, Charles II.

**Elizabeth of Valois**, vä-lwä, or **Isabella**, Queen of Spain: b. Fontainebleau, France, 22 Nov. 1545; d. Madrid 3 Oct. 1568. She was a daughter of Henry II., of France, and Catharine de Medici. She was destined to be the wife of the infante, Don Carlos, but his father, Philip II., being left a widower, became fascinated and married her himself. The story of a romantic relationship between Elizabeth and Don Carlos has furnished tragic subjects to Otway, Campiestron, Chénier, Schiller, and Alfieri.

**Elizabeth, Cape.** See CAPE ELIZABETH.

**Elizabeth, N. J.**, city, county-seat of Union County; on Newark Bay and the Arthur Kill; and on the Pennsylvania, Lehigh Valley, Baltimore & O., Philadelphia & R., and New Jersey C. R.R.'s; 14 miles southwest of New York. A ferry across the Arthur Kill connects the city with Elizabethport. It covers a wide expanse of level land, is laid out with broad and handsome streets, running at right angles, has numerous business blocks, and is noted for the large number of handsome residences of New York business men. The chief articles manufactured are sewing-machines, oilcloth, hats, saws, mill-machinery, stoves, hardware, edge tools, harness, cordage, and combs. A large business is done in the shipment of anthracite coal. The Crescent Steel Works and shipyard, in which several naval vessels have been built, are located here. Among public institutions are, the Alexian Brothers Hospital, General Hospital, Orphan Asylum, Home for Aged Women, and Public Library. The educational institutions include the Battin and Pingry high schools, the Vail-Deane School, and a business college. The city has electric lights and street railways, many old and handsome churches, two national and several private banks, building and loan associations. Elizabeth has considerable historical interest. It was settled in 1665 as Elizabethtown, and was the capital of New Jersey from 1755 to 1757. It contains an old tavern where Washington stopped on his way to New York for his first inauguration, Gen. Winfield Scott's home, the Boudinot House, and the old Livingston Mansion. Pop. (1900) 52,130.

**Elizabeth City, N. C.**, town, county-seat of Pasquotank County; on the Pasquotank River, and the Norfolk & S. R.R.; about 145 miles northeast of Raleigh. A State normal school is located here. The region about is adapted.

## ELIZABETH ISLANDS — ELKHORN

for agriculture, lumbering, and cotton raising. The manufactures of the town are varied, including cotton, flouring-, saw- and planing-mills, ship-building, and brick yards, carriage and wagon factories. The town was founded in 1793, and now has a government consisting of a mayor and a municipal council. A naval victory was gained here by the Federals under Commodore Rowan, 10 Feb. 1862. Pop. 6,500.

**Elizabeth Islands**, a Massachusetts group, 16 in number, forming the town of Gosnold, in Dukes County. They are situated between Vineyard Sound and Buzzard Bay; area, 14 square miles. In 1602 the first New England settlement was made on one of these islands, Cuttyhunk, by Bartholomew Gosnold; but after a residence of a few weeks it was abandoned, and Gosnold returned to England (see GOSNOLD, BARTHOLOMEW). The islands are now favorite summer resorts. Pop. 164.

**Elizabethan Architecture**, a style of architecture, which began to prevail in England during the reigns of Elizabeth and James I. It was a mixture of inferior Gothic with debased Italian, often very picturesque, but without purity and unity of design. It was characterized by deeply embayed windows, galleries of great length, very tall and elaborate chimneys, strap work in the parapets and window-heads, and many dormanted details of surface-carving characteristic of the bizarre influence of the combined Renaissance forms from Germany and Holland. The names of Holbein and John of Padua are associated with this style of architecture in which they had hoped to revive classic models.

**Elizabetopol**, э-лэ-зä-bet-poly', or **Yelizavetpol**, Russia. (1) A government in the southern part of Russia, area, 16,721 square miles; pop. 890,563. (2) A city in the Caucasus, capital of the government of Elizabetopol. Pop. 35,129.

**Elizabethtown**, Ky., city, county-seat of Hardin County; on the Louisville & N., and the Illinois C. R.R.'s; about 40 miles south of Louisville. The city is the centre of the trade in asphalt for which the county is noted, and it does a large business in live stock and agricultural products. Pop. 2,000.

**Elizabethtown**, N. Y., village, county-seat of Essex County; on the Bouquet River, 12 miles west of Westport, the nearest railroad station. Westport is on Lake Champlain and on the Delaware & Hudson Railroad. Elizabethtown is in the Adirondacks, on a height overlooking several beautiful valleys. It is a famous summer resort, and has quite a population in July and August. Pop. (1900) 491.

**Elk**, or **Moose**, the largest living representative of the deer family, the genus *Alces*, in America, called the moose. It is six and one half to seven feet tall at the shoulder; weighs from 1,000 to 1,500 pounds; is grayish-brown in color with light underparts, and carries a pair of magnificently spread antlers. These are peculiar in that they grow at right-angles to the plane of the face, and are broadly palmate, in two portions, the anterior usually the larger of the two. These antlers have been known to weigh as much as 60 pounds. The elk is further distinguished by having long limbs, a short neck, long flapping ears, a long narrow head,

terminating in a broad overhanging muzzle, and small, sunken eyes. The tail is merely rudimentary. In captivity, or even in comparison with other deer, the elk is ugly and rather ungainly. Yet, seen in the forest he presents a thoroughly majestic front to the hunter, and can move as swiftly and more noiselessly than the less bulky and more graceful members of the family. See **MOOSE**.

The elk of Europe is found on the continent, and to the far north in Scandinavia, northern Russia, and northern Prussia. In America, the moose has retreated to a great extent, toward the Northwest; and it is fairly common throughout Canada and Labrador. The summer home of the elk is near fresh water, where he can feed upon the succulent herbage. In winter he retires to the fastnesses of heavily wooded timber-land, where his food consists of twigs, leafbuds, and certain species of lichens. Like the red-deer, the elk fights for possession of his consort; and fierce combats are waged in the early autumn between stags whose antlers have matured during the retirement of summer. The peculiar blood-curdling challenge, uttered by the male at this season, is reproduced through a short trumpet of rolled birch-bark by both Indian and white hunters, who thus lure the eager elk within shooting distance of their ambush. On account of the power of endurance and strength of the creature, it is frequently made symbolic; and in many localities in Canada, persons of unusual physical power are said to be "As strong as a bull-moose." It is easily domesticated and made to draw sledges.

Of fossil species, the best known is the Irish Elk, found in the Pleistocene strata, and distinguished by its enormous antlers, the tips of which are sometimes 11 feet apart, but which differ from those of living species in that the beam is flattened into a palm. To sustain their great weight, unusually large and strong limbs, and neck vertebra, were required. While found chiefly in the peat bogs of Ireland, its remains have been discovered also in Great Britain and throughout Europe in lacustrine deposits, brick clay, and ossiferous caves.

Consult: Lydekker, 'Deer of all Lands' (London 1898); Afalo, 'Sport in Europe' (London 1901); Roosevelt (and others), 'The Deer Family' (New York 1902), and general works on zoology and sport in North America.

**Elkesaites**. See **ELCESAITES**.

**Elkhart**, Ind., city, in Elkhart County, at the confluence of the St. Joseph and Elkhart Rivers, and on the Cleveland, C. C., & St. L., the Lake Shore and the Elkhart & W. R.R.'s; 101 miles east of Chicago. It is a railroad centre and shipping point for a large agricultural region. The rivers afford excellent water power. The Lake Shore railroad shops are located here and the manufacturing interests include brass, carriage, starch, bicycle, and paper factories. Elkhart is the seat of Elkhart Institute and has public schools, business colleges, and high school, daily and weekly newspapers, gas and electric lights, electric railways, waterworks and two national banks. Pop. (1900) 15,184.

**Elkhorn**, a river in Nebraska formed by the junction, in Madison County, of the North Fork, which has its rise in Brown County, and

the South Fork which rises in Knox County. The general course is southeast, 260 miles, when it flows into the Platte River.

**Elkin, William Lewis**, American astronomer: b. New Orleans 29 April 1855. He was educated at the Royal Polytechnic School in Stuttgart, Germany, and was graduated in 1880 at the University of Strasburg. He then went to the Cape of Good Hope on the invitation of Sir David Gill, English astronomer there, and took part with him in observations with the heliometer for the determination of stellar parallax, these determinations being the most accurate of the kind ever made up to that time. He became astronomer at the Yale College observatory in 1884, where he has continued his excellent work in stellar parallax.

**Elkins, Stephen Benton**, American politician: b. Parry County, Ohio, 26 Sept. 1841. He removed to Missouri when a child; was graduated at the University of Missouri in 1860; and admitted to the bar in 1863. During the latter year he went to New Mexico, where he was a member of the Territorial legislature in 1864-5; and the Territorial delegate in Congress in 1873-7. Subsequently he removed to West Virginia, and became interested in railroads and coal mining. In 1891-3 he was secretary of war, and in 1894 was elected to the United States Senate.

**Elks, Benevolent and Protective Order of**, a convivial, charitable, and benevolent organization founded by members of the theatrical profession in New York in 1868, but now admitting to membership men in other professions and occupations. The order has one grand lodge and 820 sub-lodges throughout the country. The membership in the United States (1903) numbered more than 130,000, including many prominent men. Though not a beneficial order, it is claimed that it expends more in unostentatious charity than any other organization in the world. The benefits disbursed since organization amount to \$1,250,000, with an annual average distribution at present of upward of \$150,000.

**Elkton, Ky.**, city, county-seat of Todd County; on a branch of the Louisville & N. R.R., near the southern boundary of the State, about 45 miles north by west of Nashville, Tenn. Its trade is exclusively in farm products, including tobacco and hops. The city has a reputation as an educational centre, its chief institution being the Vanderbilt Training School, which is under the auspices of the Methodist Episcopal Church. Pop. (1900) 1,123.

**Ellagic Acid**, or **Bezoardic Acid**,  $C_8H_6O_8$ , is separated from Oriental bezoars by dissolving them in cold strong potash, away from the air, passing a current of carbolic acid, collecting the ellagate of potassium, washing and recrystallizing it, and then liberating the ellagic acid by hydrochloric acid. It is insoluble in water, but dissolves in alcohol. It is a pale yellow, tasteless, crystalline powder, decomposed on heating. With the bases it forms salts, which are not very well known: they are crystalline, and insoluble or sparingly soluble in water. The lead and barium compounds are yellow. This acid can also be obtained from gallic acid, of which it is a product of oxidation. It was from this source that it was first got by Chevreul; it was afterward identified by Wöhler with that from

bezoars. It appears to be doubtful whether it occurs ready formed in gall-nuts, or whether it is produced in the process of extraction.

**El'land**, England, town in the West Riding of Yorkshire, on the river Calder, three miles southeast of Halifax. It has some cloth-mills, and there are valuable stone quarries in the vicinity. Pop. 10,485.

**Ellenborough, ĕl'lĕn-bŭr-ō, Edward Law, Lord**, English lawyer: b. Great Salkeld, Cumberland, 16 Nov. 1750; d. London 13 Dec. 1818. He was educated at Cambridge, and was called to the bar in 1780. On the trial of Warren Hastings in 1785, Erskine having refused to undertake the defense, Law served as leading counsel. It required no little courage to encounter such opponents as Burke, Fox, Sheridan, and other eminent men of the time, who conducted the impeachment. Law, as is well known, obtained the victory. In 1801 he was made attorney-general, and in 1802 became lord chief justice of the king's bench, and was created baron. He adopted the title Ellenborough from a small fishing village of that name, where his ancestors had lived for a long time. In Parliament he was opposed to the emancipation of the Catholics. He held the office of chief justice for 15 years.

**Ellenborough, Edward Law, 1st Earl of**, English statesman: b. 8 Sept. 1790; d. near Cheltenham 22 Dec. 1871. He was educated at Eton and Cambridge; entered Parliament as representative of St. Michael's in 1814, and in 1818 succeeded his father as second baron, and entered the House of Lords. He was lord privy-seal in 1828, and in 1841 accepted the governor-generalship of India. He arrived in Calcutta in time to take control of the Afghan war, which was brought to a successful issue. Scinde was conquered by Sir Charles Napier, and annexed in 1843. This was followed by the conquest of Gwalior. The conduct of the governor-general, however, gave great dissatisfaction at home. His policy at first had been vacillating, and latterly too warlike, and the vanity and indiscretion of his proclamations were looked upon as seriously impugning the soundness of his judgment. He was consequently recalled by the East India Company early in 1844. Under Lord Derby's government in 1858 he held the office of president of the board of control from February to June, during which he wrote a despatch censuring the policy of Lord Canning as governor-general of India, which caused much discussion, and led him to resign his office.

**Ellensburg, Wash.**, county-seat of Kittitas County; on the Yakima River, and on the North P. R.R., about 130 miles southeast of Seattle. The industries of the city are those that belong to a combined mining and agricultural region. One of the normal schools of Washington is situated there. Pop. (1900) 1,737.

**Ellenville, N. Y.**, a popular summer resort in Ulster County; on the New York, O. & W., and a branch of the Erie R.R.'s; about 20 miles west of the Hudson River. It was at one time a busy agricultural centre, but now its chief industry is the quarrying of blue-stone. Pop. (1900) 2,879.

**Eller, Johann Theodor**, German chemist: b. Plötzkau, in Anhalt-Bernburg, 29 Nov. 1689; d. Berlin 13 Sept. 1760. In 1721 he was ap-

## ELLERIANS — ELLICOTT

pointed Anhalt-Bernburg physician; in 1724, professor of anatomy in Berlin; in 1735, physician to Frederick the Great; in 1755, privy councillor and director of the physical class of the Academy of Sciences. His papers were published in the 'Memoirs of the Berlin Academy,' and among them is a long and interesting review of the opinions held respecting the elements from the earliest times down to his own day. He also published a series of curious microscopic observations upon the change of blood corpuscles by the addition of different salts, tinctures of plants, and other solutions. Eller was undoubtedly a man of great learning and abilities, but his writings do not indicate a high degree of originality.

**Ellerians**, a sect of fanatics which arose in 1726, and had for its founder Elias Eller, a ribbon-weaver, who was born in 1690 at Ronsdorf in Berg. He was influenced in his religious beliefs by reading the works of Jacob Böhme, and other mystical writings. The sect committed great excesses, and became very numerous. See BÖHME, JACOB.

**Ellery, William**, American patriot: b. Newport, R. I., 22 Dec. 1727; d. there 15 Feb. 1820. He sat in the Congress of 1776, and was one of the signers of the Declaration of Independence. From 1790 till his death, he retained the office of collector in his native place.

**Ellesmere, ěl'z'mēr, Francis Egerton, EARL OF**, English author: b. London 1 Jan. 1800; d. there 18 Feb. 1857. His 'The Pilgrimage and Other Poems' (1856) constitutes his most valid title to fame, though he wrote much and well on biographical, historical, and literary subjects.

**Ellesmere Land**, the most northern region of the continent of North America, discovered by Baffin in 1616. The western part of this region was explored and mapped by Sverdrup, Otto (q.v.) in 1899. Ellesmere Land is a high plateau, without human inhabitants; a few reindeer, musk-oxen, and wolves find sustenance there. It is separated from Greenland by Smith Sound.

**Ellet, Charles**, American engineer: b. Penn's Manor, Bucks County, Pa., 1 Jan. 1810; d. Cairo, Ill., 21 June 1862. He was educated at the Polytechnic School in Paris, and on his return to America held various responsible engineering posts. He built at Fairmount, Philadelphia, the first wire suspension bridge in the United States, and in 1845 declared that a bridge could be built at Niagara below the Falls adapted for railway purposes. In the Civil War he equipped nine Mississippi River steamboats as rams, and with them defeated a fleet of Confederate rams, but died of wounds on that occasion.

**Ellet, Elizabeth Fries Lummis**, American prose writer: b. Sodus Point, N. Y., October, 1818; d. New York 3 June 1877. She was popular in her day, and among her books are a translation of Silvio Pellico's 'Euphemia of Messina' (1834); 'Poems, Original and Selected' (1835); 'Characters of Schiller' (1842); 'Pioneer Women of the West' (1852); 'Novelettes of the Musicians' (1852); 'Queens of American Society' (1867); 'Court Circles of the Republic' with Mrs. R. E. Mack (1869); 'The Practi-

cal Housekeeper'; 'Evenings at Woodlawn'; 'Women Artists in All Ages.'

**Ellice, ěl'is, or Lagoon Islands**, a group of coral islands, situated north of the Fiji and northwest of the Samoan group. They extend for 360 miles in a direction northwest to southeast, and form nine groups, the largest islands being Sophia or Rocky Island, Nukulailai or Mitchell, Ellice, Nukufetau, Vaitupu, Netherland, and Lynx. The inhabitants almost all speak a Samoan dialect, and have traditions of a migration from the Samoan islands. They have long been Christianized, and reading and writing are general. The cocoanut is widely cultivated. These islands were annexed by Great Britain in 1892. Area, 14 square miles. Pop. 2,400.

**Ellichpur, ěl-ich-poor'**, India, town in Ellichpur district, Berar, once large and prosperous. There is a military cantonment within two miles. The town contains many interesting ruins, including a palace, several fine tombs, and an old well. Pop. 36,240.

**Ellicott, Andrew**, American astronomer and civil engineer: b. Bucks County, Pa., 24 Jan. 1754; d. West Point, N. Y., 28 Aug. 1820. His father founded the town of Ellicott's Mills, Maryland, where the younger days of his son Andrew were devoted to the study of the sciences and practical mechanics. The latter's scientific attainments early attracted public attention, and from the Revolution to the day of his death he was employed in the fulfilment of trusts conferred by the general or State governments. About 1785 he removed to Baltimore, and represented that city in the State legislature. In 1789 he was appointed by President Washington to survey the land lying between Pennsylvania and Lake Erie, and during that year made the first accurate measurement of the Niagara River from lake to lake, with the height of the falls and the fall of the rapids. In 1790 he was employed by the government to survey and lay out the federal metropolis. In 1792 he was made surveyor-general of the United States, and in 1795 superintended the construction of Fort Erie at Presque Isle (now Erie, Pa.), and was employed in laying out the towns of Erie, Warren, and Franklin. In 1796 he was appointed by President Washington commissioner on behalf of the United States under the treaty of San Lorenzo el Real, to determine the southern boundary separating the United States territory from the Spanish possessions. The results of this service, embracing a period of nearly five years appear in his 'Journal' (published 1803). Upon the completion of this service he was appointed by Gov. McKean of Pennsylvania, secretary of the State land office, the duties of which he performed to the year 1808, and in 1812 became professor of mathematics at West Point. In 1817, by order of the government, he proceeded to Montreal to make astronomical observations for carrying into effect some of the articles of the Treaty of Ghent.

**Ellicott, Charles John**, English Anglican prelate: b. Whitwell, Stamford, England, 25 April 1819. He was educated at St. John's College, Cambridge, and after being professor of divinity in King's College, London, Hulsean lecturer and professor of divinity at Cambridge, and dean of Exeter, was appointed bishop of Gloucester and Bristol in 1863. In 1897 the



diocese of Bristol was separated from that of Gloucester, Bishop Ellicott remaining at the head of the latter diocese. He was for 11 years chairman of the scholars engaged on the revision of the New Testament translation, and has published commentaries on the Old and New Testaments, as well as 'Historical Lectures on the Life of Christ'; 'Modern Unbelief' (1877); 'Some Present Dangers of the Church of England' (1878); 'Spiritual Needs in Country Parishes' (1888); 'Sacred Study' (1892-4); 'The Revised Version of Holy Scripture' (1901); etc.

**Ellicott, Henry J.**, American sculptor: b. near Ellicott City, Md., 1848; d. Washington, D. C., 11 Feb. 1901. His best-known works include bronze statues for the 1st and 2nd Pennsylvania Volunteers on the battlefield at Gettysburg, the equestrian statues of Gen. Hancock in Washington and Gen. McClellan in Philadelphia; and memorial monuments in various parts of the United States.

**Ellicott City, Md.**, county-seat of Howard County; on the Patapsco River; eight miles west of Baltimore. St. Charles College (R. C.) in charge of secular clergy, and Rock Hill College, in charge of Brothers of the Christian Schools, are located here. The manufactures and trade are chiefly local. Pop. 1,408.

**Ellinwood, Frank Fields**, American clergyman and author: b. Clinton, N. Y., 20 June 1826. He was graduated at Hamilton College in 1849; was ordained a minister in the Presbyterian Church in 1853; and became secretary of foreign missions for that denomination in 1871. His chief works are: 'The Great Conquest' (1876); 'Oriental Religions and Christianity' (1892); 'Questions and Phases of Modern Missions' (1899).

**Elliot, Daniel Giraud**, American zoologist: b. New York 7 March 1835. He made zoology a special study from his youth; traveled in Europe, Africa, and parts of Asia in 1856-78; subsequently in Canada, Alaska, South America, and the greater part of the United States. He afterward became curator of zoology in the Field Columbian Museum. He has published: 'The Pheasants'; 'Birds of North America'; 'The Grouse'; 'Birds of Paradise'; 'Hornbills'; etc. He has been decorated 10 times by various European governments for his researches in natural science.

**Elliot, Sir Gilbert**, Scottish philosopher and poet: b. Teviotdale September 1722; d. Marseilles 11 Jan. 1777. His song of 'Amynta' beginning "My sheep I neglected, I broke my sheep hook," is famous; he also wrote occasional philosophical papers.

**Elliot, Henry Rutherford**, American journalist: b. Woodbridge, N. J., 1849. He has published: 'The Bassett Claim, a Story of Life in Washington' (1887); 'The Common Chord, a Story of the Ninth Ward' (1888); and other fictions.

**Elliot, Jane**, Scottish poet, sister of Sir Gilbert Elliot: b. Teviotdale, 1727; d. there 29 March 1805. She wrote 'The Flowers of the Forest' (1756), a song of Flodden Field.

**Elliot, Arthur Ralph Douglas**, Scottish lawyer and author: b. 17 Dec. 1846. He was educated at Edinburgh and Cambridge, was called to the bar in 1880, and was a member of

Parliament for Roxburghshire 1880-92, and for the city of Durham 1898-1900. He has been editor of 'The Edinburgh Review' from 1895 and is the author of: 'Criminal Procedure in England and Scotland'; 'The State and the Church' (1881).

**Elliott, Charles**, American Methodist clergyman: b. Glenconway, County Donegal, Ireland, 16 May 1792; d. Mount Pleasant, Iowa, 3 Jan. 1869. He came to the United States in 1814 and became prominent in the Methodist denomination. He was a professor of languages at Madison College, Uniontown, Pa., 1827-31, and president of Iowa Wesleyan University 1856-60 and 1864-7. He published: 'Treatise on Baptism' (1834); 'Sinfulness of American Slavery' (1851); 'The Bible and Slavery'; etc.

**Elliott, Charles Loring**, American painter: b. Scipio, N. Y., December 1812; d. Albany, N. Y., 25 Aug. 1868. His works consist almost exclusively of portraits, many of which are of eminent American citizens, and are remarkable for the fidelity of the likeness and their vigorous coloring. In 1846 he became a member of the National Academy of Design.

**Elliott, Charles Wylls**, American novelist and historian: b. Guilford, Conn., 27 May 1817; d. 20 Aug. 1883. Settling in New York, he was one of the founders and trustees of the Children's Aid Society in 1853, and in 1857 was one of the commissioners for laying out Central Park. He published among other works: 'Cottages and Cottage Life' (1848); 'Mysteries, or Glimpses of the Supernatural' (1852); 'The Book of American Interiors'; 'Pottery and Porcelain'; 'Remarkable Characters and Places in the Holy Land'; 'St. Domingo, Its Revolution and Its Hero'; 'Wind and Whirlwind,' a novel; etc.

**Elliott, Charlotte**, English hymn-writer: b. 17 March 1789; d. Brighton 22 Sept. 1871. She wrote a number of religious poems, which were published under the titles: 'Hymns for a Week'; 'Hours of Sorrow'; 'Invalids' Hymn Book.' The last collection included 'Just as I Am,' a hymn which is widely used, and has been translated in "almost every living language."

**Elliott, Ebenezer**, English poet: b. Masborough, near Sheffield, 17 March 1781; d. Great Houghton, near Barnsley, 1 Dec. 1840. At first a foundry hand, his poetic gift was used in denouncing the exploitation of the proletariat by a capitalistic oligarchy; yet the bitterness and exaggerated rhetoric one would expect under such circumstances are wholly absent from 'Corn Law Rhymes' (1831), and 'More Prose and Verse' (1850). He was famed in his day as 'The Corn Law Rhymist.'

**Elliott, Sir Henry Miers**, English historian: b. Westminster 1808; d. Simon's Town, Cape of Good Hope, 20 Dec. 1853. Long an Indian civil servant, he compiled 'Memoirs of the History, Folk Lore, and Distribution of the Races of the Northwestern Provinces of India' (1869), and 'The History of India as Told by Its Own Historians: The Mohammedan Period' (1867-77).

**Elliott, Henry Wood**, American naturalist and artist: b. Cleveland, Ohio, 13 Nov. 1846. In 1862-78 he was private secretary to Joseph



## ELLIOTT—ELLIPSIS

Henry, secretary of the Smithsonian Institution; in 1869-71 artist of the United States Geological Survey; and in 1872-4 and 1890 a special commissioner for the investigation of the Seal Islands of Alaska. His publications include: 'Monograph of the Seal Islands' (1881), and 'Our Arctic Province, Alaska' (1886); 'The Seal Islands of Alaska' (1894).

**Elliott, Jesse Duncan**, American naval officer: b. Maryland 1782; d. 1845. He entered the United States navy as a midshipman 1804, and in October of 1812 won the first American naval success on the lakes, capturing two British brigs, the *Detroit* and the *Caledonia*, near Fort Erie. He commanded the *Niagara*, in the battles of Lake Erie, September 1813, being second in command to Perry, whom he succeeded in October of the same year as commander of the Lake Erie fleet. In 1815, during the war against Algiers, he was in command of the sloop of war *Ontario*, under Decatur, being appointed captain in 1818.

**Elliott, Maud Howe**, American novelist: b. Boston, Mass., 9 Nov. 1855. She is a daughter of Julia Wood Howe (q.v.), and was married to John Elliott, an artist, in 1887. Her writings include: 'A Newport Aquarelle' (1883); 'The San Rosario Ranch' (1884); 'Atalanta in the South' (1886); 'Mammon' (1888); 'Honor'; and 'Phyllida.'

**Elliott, Maxine**, American actress: b. Rockland, Me. Making her début with E. S. Willard, she played Felicia Umfraville in 'The Middleman' (1890), and later in 'The Professor's Love Story.' She was with Rose Coghlan, and in 1895 went to London with Augustin Daly's company. A member of N. C. Goodwin's company 1896, she played in Clyde Fitch's 'Nathan Hale' (1898); was married to Mr. Goodwin that year, and appeared with him in 'When We Were Twenty-One,' playing Portia in 1901.

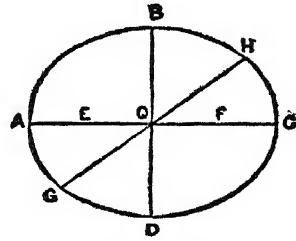
**Elliott, Sarah Barnwell**, American novelist. She is a granddaughter of Stephen Elliott (q.v.). Her best-known works are: 'The Felmers' (1879); 'Jerry'; 'John Paget'; 'Sam Houston'; 'The Durket Sperret' (1898); 'An Incident and Other Happenings' (1899).

**Elliott, Stephen**, American naturalist: b. Beaufort, S. C., 11 Nov. 1771; d. Charleston 28 March 1830. He was graduated at Yale College in 1791, and was president of the "Bank of the State" from 1812 till his death. His leisure hours were devoted to literary and scientific pursuits, and he cultivated the study of botany with enthusiasm. In 1825 he aided in establishing the medical college of the State, and was elected one of the faculty, and professor of natural history and botany. He was the author of the 'Botany of South Carolina and Georgia' (1821-4).

**Elliott, William**, American miscellaneous writer: b. Beaufort, S. C., 27 April 1788; d. there. He was educated at Yale, and devoted himself mainly to agriculture and rural sports. His published works include: 'Fiesco,' a tragedy (1850); and 'Carolina Sports by Land and Water' (1856).

**Ellipse** (Lat. *ellipsis*, from Gr. *elleipsis*, omission), a plane curve of such a form that, if from any point in it two straight lines be drawn to two given fixed points, the sum of

these straight lines will always be the same; a geometrical term used in conic sections. These two fixed points are called the foci. In the ellipse A B C D, E and F are the foci. If a straight line (E Q F) be drawn joining the foci, and be then bisected, the point of bisection is called the centre. The distance from the centre to either focus (E Q or Q F) is called the eccentricity. The straight line (G Q H), drawn through the centre and terminated both ways by the curve, is called the diameter. Its vertices are G and H. The diameter A C, which passes through the foci, is called the major axis; the points in which it meets the curve (A and



C), the principal vertices. The diameter (B D), at right angles to the major axis, is called the minor axis. Practically, a tolerably accurate ellipse may be drawn on paper by sticking two pins in it to represent the foci, putting over these a bit of thread knotted together at the ends, inserting a pencil in the loop, and pulling the sheet tight as the figure is described. The importance of the ellipse arises from the fact that the planets move in elliptical orbits, the sun being in one of the foci—a fact which Kepler was the first to discover.

The equation to an ellipse, referred to its centre as origin, and to its major and minor axes as rectangular axes, is  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , where  $a$  and  $b$  are the semi-major and semi-minor axes respectively. From this equation it may be shown, by the integral calculus, that the area of an ellipse is equal to  $\pi ab$ ; or is got by multiplying the product of the semi-major and semi-minor axes by 3.1416. It may also be shown that the length of the circumference of an ellipse is got by multiplying the major axis by the quantity

$$\pi \left\{ 1 - \left( \frac{1}{2} \right)^2 \frac{e^2}{1} - \left( \frac{1.3}{2.4} \right)^2 \frac{e^4}{3} - \left( \frac{1.3.5}{2.4.6} \right)^2 \frac{e^6}{5} - \&c., \right\}$$

to which there is an excellent practical approximation, namely:

$$\frac{\pi}{2} \left( a + b \sqrt{2(a^2 + b^2)} \right)$$

The eccentricity  $e$ , is  $= \sqrt{1 - \frac{b^2}{a^2}}$  and the ellipticity is the ratio  $a-b$  to  $a$ .

**Ellip'sis**, in grammar, the omission of one or more words, which may be easily supplied by the connection. It is common, especially in colloquial language, for the sake of brevity, and frequently adds to the strength and perspicuity of the sentence. Hence a more extended use of the ellipsis in rhetoric and poetry. In the hands of a genuine poet or orator the ellipsis

has a very telling value. In natural language, from the brevity it affords, the ellipsis becomes in all its phases the language of passion, and especially of sudden and intense emotion; and the imitation of its natural use in this way is to the poet the most powerful instrument for painting passion to the life. The works of all the greater poets, and especially the Hebrew poetry of the Old Testament, abounds with familiar instances of this use of the ellipsis.

**Ellipsoid**, in geometry, a solid figure produced by the revolution of an ellipse about its axis, and all plane sections of which are ellipses or circles. The earth, generally said to be an oblate spheroid, has been designated also an oblate ellipsoid.

**Ellis, Alexander John** (originally Sharpe), English scientist and philologist: b. Hoxton 14 June 1814; d. London 28 Oct. 1890. He was educated at Shrewsbury, Eton, and Trinity, Cambridge, and devoted himself to mathematics, the scientific side of music, and more especially to philology and phonetics. His translation of Prof. Helmholtz's 'Sensations of Tone' (1875), has taken a place as a standard work on scientific music. In 1848 he published two small works: 'The Essentials of Phonetics'; and 'A Plea for Phonetic Spelling,' and collaborated with Sir Isaac Pitman (q.v.) in framing a phonetic system. His *magnum opus* on 'Early English Pronunciation,' with special reference to Chaucer and Shakespeare, appeared between 1869 and 1889.

**Ellis, Edward Sylvester**, American writer of school text-books and juvenile literature: b. in Geneva, Ohio, 11 April 1840. For some years he was superintendent of public schools at Trenton, N. J. Besides 'The People's Standard History of the United States' and several school histories, his works include: 'The Boy Pioneer Series' (1883-4); 'The Camp Fires of Gen. Lee' (1887); 'The Hunters of the Ozark' (1887); 'The Great River Series' (1888); 'Storm Mountain,' and many other juveniles.

**Ellis, George**, English author: b. London, England, 1745; d. April 1815. He was educated at Westminster School and Trinity College, Cambridge, and was one of the junta of wits concerned in the well-known political satire, 'The Rolliad.' He published: 'Specimens of the Early English Poets, with an Historical Sketch' (1790); 'Specimens of Early English Metrical Romances' (1805); and was an intimate friend of Sir Walter Scott.

**Ellis, George Edward**, American Unitarian clergyman and historical writer: b. Boston, Mass., 8 Aug. 1814; d. there 20 Dec. 1894. He was pastor of the Harvard (Unitarian) Church, Charlestown, Mass., 1840-69; and held the professorship of systematic theology in the Cambridge Divinity School 1857-63. As president of the Massachusetts Historical Society he made valuable contributions to early colonial history. He published: 'A Half-Century of the Unitarian Controversy' (1857); 'History of the Battle of Bunker's Hill' (1875); 'The Red Man and the White Man' (1882); 'The Puritan Age and Rule in the Colony of Massachusetts Bay, 1629-85'; various memoirs, and several biographies in Sparks' 'American Biography.'

**Ellis, Henry Havelock**, English scientist and literary scholar: b. Croydon, Surrey, 2 Feb.

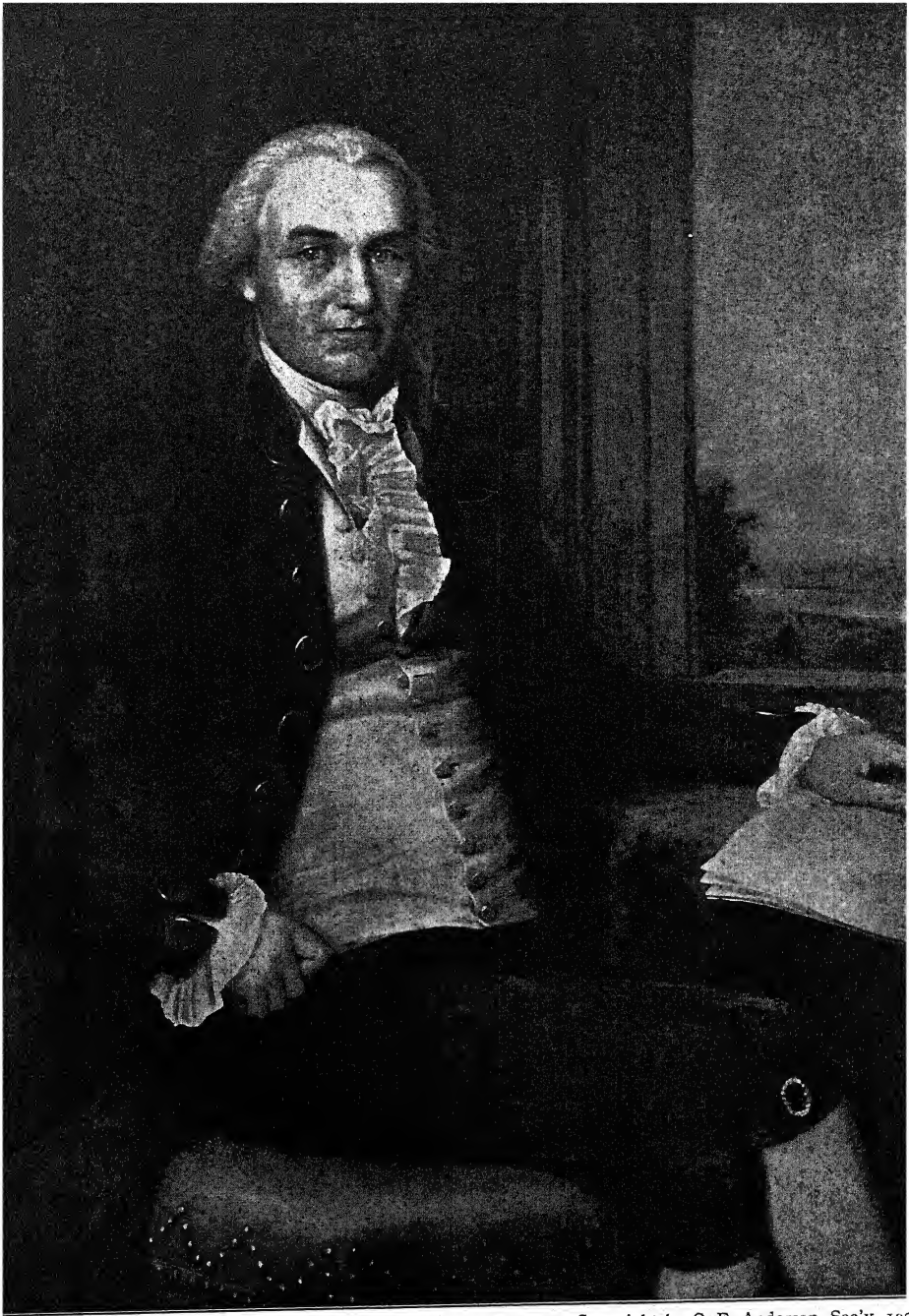
1859. He taught school in New South Wales 1875-9, and on his return to England practised medicine for a short time and then devoted himself to literary and scientific work. He is a Fellow of the Medico-legal Society of New York, and honorary Fellow of the Chicago Academy of Medicine, and has been general editor of the 'Contemporary Science Series' from 1889. He edited the 'Mennaid Series of Old Dramatists' (1887-9); and is the author of 'The New Spirit' (1890); 'The Criminal' (1890, enlarged 1901); 'Man and Woman: a Study of Human Secondary Sexual Characters' (1894); 'Sexual Inversion,' being Vol. I. of 'Studies in the Psychology of Sex' (1897); 'Affirmations' (1897); 'The Evolution of Modesty,' being Vol. II. of 'Studies in the Psychology of Sex' (1899); 'The 19th Century: a Dialogue in Utopia' (1900); 'Analysis of the Sexual Impulse,' being Vol. III. of 'Studies in the Psychology of Sex' (1902).

**Ellis, Job Bicknell**, American botanist: b. Potsdam, N. Y., 1829. With B. M. Everhart he has published: 'North American Pyrenomyces' (1892); and 'North American Fungi' (1878-93).

**Ellis, John**, English naturalist: b. London about 1710; d. 1776. He was the first who suggested the idea that the South Sea islands were constructed and raised from the bottom of the ocean by means of zoophytes or the polypi inhabiting different species of coral ('Essay Towards a Natural History of Corallines' 1754). He was for some time agent for the colony of West Florida and the island of Dominica. Among his works is a posthumous one entitled 'The Natural History of Many Curious and Enormous Zoophytes' (1786).

**Ellis, Robinson**, English classical scholar: b. Barming, Kent, 5 Sept. 1834. He was educated at Rugby and Balliol College, Oxford; and in 1870 became professor of Latin in University College, London. From 1883 till 1893 he was university reader in Latin literature at Oxford, and in the latter year he was elected to the corpus professorship of Latin. His name is chiefly associated with the elucidation of the poems of the Roman poet Catullus. In 1867 he published a critical edition of Catullus ('Catulli Veronensis Liber'), and in 1871 'The Poems and Fragments of Catullus' in the metres of the original, these works being followed by a 'Commentary on Catullus' (1876). Other publications of his include: Ovid's 'Ibis,' with commentary (1881); 'Fables of Avianus' (1887); 'Noctes Manilianæ' (1891); 'The Fables of Phædrus' (1894); and a new recension of 'Velleius Paterculus,' with commentary.

**Ellis, Sarah Stickney**, English author: b. London, England, 1812; d. Hoddesdon, Herts, 16 June 1872. She was the wife of William Ellis (q.v.). Among her works the best known are: 'Women of England' (1838); and 'Daughters of England' (1842). Still others are: 'Poetry of Life' (1838); 'Summer and Winter in the Pyrenees' (1841); 'The Island Queen' (1846), a poem; 'Fireside Tales' (1848); 'The Brewer's Family' (1863); 'William and Mary' (1865); 'Northern Roses.'



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OLIVER ELLSWORTH.

CHIEF JUSTICE OF THE UNITED STATES SUPREME COURT, 1796-1800.



**Ellis, T. Mullett**, English poet and novelist: b. 29 Dec. 1850. He is the founder and editor of 'The Thrush,' a magazine for original verse, and has published: 'The Earl's Nose,' humorous verse; 'Reveries of World History' (1893); 'The Beauty of Boscastle' (1894); 'Zalma' (1895); 'Tales of the Klondike'; 'God is Love' (1898); 'Kitty, a Story of the Transvaal War'; etc.

**Ellis Island**, a small island owned by the United States government, and used as an immigrant station. It is situated in New York Bay, one mile southwest of the Battery, where the old immigrant station, Castle Garden, was located. The United States immigrant commissioner has his offices on this island. Immigrants detained for investigation as to compliance with the United States immigration laws, are kept on this island until allowed to land or are deported. See IMMIGRATION LAWS.

**Ellora**, ६-1०'rā, **Elora**, or **Eluru**, ६-loo'rā, India, village in the province of Aurungabad; celebrated for some remarkable cave temples, excavated in the solid rock, which in magnitude and perfection surpass all other constructions of the kind in India.

**Ellore**, ६-lōr', India, town, in the Godavari district of the Madras presidency, on the river Jammaler, once the capital of the Northern Circars. It has magisterial and judicial establishments, police station, post-office, etc., a number of Christian missions, and a garrison. There are some manufactures of carpets and salt-petre. Pop. 29,382.

**Ells, Robert Wheelock**, Canadian geologist: b. Cornwallis, N. S., 26 July 1845. He was graduated at McGill University in 1872, and in May of that year joined the staff of the Canadian Geological Survey, of which he later became senior geologist. He is the author of numerous reports on geology and mineral resources, published in the annual volumes of the Canadian Geographical Survey since 1872.

**Ells'worth, Ephraim Elmer**, American soldier: b. Mechanicsville, N. Y., 23 April 1837; d. Alexandria, Va., 24 May 1861. He organized about 1859 a zouave corps which became noted for the excellence of its discipline. In March 1861 he accompanied President Lincoln to Washington, and in April he went to New York, where he organized a zouave regiment of firemen, of which he became colonel. Ordered to Alexandria, he lowered a Confederate flag floating over a hotel, for which act the hotelkeeper shot him dead.

**Ellsworth, Oliver**, American jurist: b. Windsor, Conn., 29 April 1745; d. there 26 Nov. 1807. He was graduated at the College of New Jersey in 1766, and soon after commenced the practice of law. In 1777 he was chosen a delegate to the Continental Congress, and in 1780 was elected a member of the council of Connecticut, in which body he continued till 1784, when he was appointed a judge of the superior court. In 1787 he was elected to the convention which framed the Federal Constitution, and was afterward a member of the State convention, where he earnestly advocated the ratification of that important instrument, which his exertions had essentially aided in producing. In 1789 he was chosen a senator of the United

States, which station he filled till 1796, when he was nominated by Washington chief justice of the Supreme Court of the United States. In 1799 he was appointed envoy extraordinary to Paris, and with his associates successfully negotiated a treaty with the French. He resigned his office of chief justice in 1800.

**Ellsworth, Timothy Edwards**, American soldier and politician: b. East Windsor, Conn., September 1836; d. Buffalo, N. Y., 10 Feb. 1904. He was admitted to the bar in 1858, and at the outbreak of the Civil War recruited a company of cavalry, of which he was made captain, and which became a part of the 7th N. Y. cavalry. He practised law at Lockport, and was elected to the State Senate in 1881, 1883, 1895, 1898, and 1900, being at one time speaker *pro tem.* and Republican leader.

**Ellsworth**, Maine, city, port of entry and county-seat of Hancock County, on both sides of the Union River, and on the Maine C. R.R.; 29 miles southeast of Bangor. It is the trade centre of the county and has extensive timber, ice, ship-building, and fishing interests, exporting over 50,000,000 feet of lumber annually. It has shoe, woolen, leather, and other manufacturing industries, a public high school, custom house, court-house, public library, two national banks, and two weekly newspapers. Pop. (1900) 4,297.

**Ell'wanger, George Herman**, American author: b. Rochester, N. Y., 10 July 1848. He was educated in Europe and has devoted himself mainly to literature. His published works are: 'The Gardener's Story, or Pleasures and Trials of an Amateur Gardener' (1889); 'The Story of My House' (1891); 'In Gold and Silver' (1892); 'Idyllists of the Country Side' (1896); 'Meditations on Gout, With a Consideration of Its Cure Through the Use of Wine' (1898); 'Love's Demesne, a Garland of Contemporary Love Poems' (edited 1896).

**Ell'wood, Thomas**, English Quaker: b. Crowell, near Thame, Oxfordshire, 1639; d. Amersham 1 March 1714. About 1660 he was induced to join the Society of Friends, and subsequently became reader to Milton, with whom he improved himself in the learned languages, but was soon obliged to quit London on account of his health. In the year 1665 he procured a lodging for Milton at Chalfont, Bucks, and was the occasion of his writing 'Paradise Regained' by the following observation made on the return of the 'Paradise Lost,' which the poet had lent him to read in manuscript: 'Thou hast said much of paradise lost, but what hast thou to say of paradise found?' In 1705 he published the first part of 'Sacred History, or the Historical Parts of the Old Testament'; and in 1709 'Sacred History, etc., of the New Testament.' His other works are numerous; among them 'Davideis, the Life of David, King of Israel, a poem, which is more distinguished for piety than poetry. His life, written by himself, and published the year after his death, affords many interesting particulars of the history of his sect.

**Elm**, *Ulmus*, a genus of trees and a few shrubs of the natural order *Ulmaceae*. The species, of which about 20 are known, are natives of the north temperate zone and the southern portions of the Arctic zone. Their

## ELM — ELM-INSECTS

southern limits seem to be the Himalayas in Asia and the mountains of southern Mexico. None are natives of the Pacific slope. They are characterized by short petioled, alternate, rough, usually deciduous, leaves with serrate edges; axillary racemes of perfect, apetalous flowers which appear in early spring before or with the leaves; and compressed, winged, dry fruits (nutlets). Many of the species are of wide economic importance. Their hard, heavy, tough, pliable wood is largely used in the manufacture of barrels, agricultural implements, boats, wagon wheels, buildings, etc., and for fuel. The inner bark of some species furnishes an article of food, and that of others a tough bast fibre used for cordage and cloth making. The outer bark of others is used in dyeing and sugar refining. Various parts of several species were formerly popular remedies employed in medicine, but except in domestic and local practice are rarely prescribed. Most of the species are highly valued as ornamental trees in street and park planting, those specially popular being the straight trunked, tall growing, vase-formed species, which quickly over-arch the streets and cast an abundant shade. Many cultivated varieties of fantastic form, color of foliage or habit of growth are also planted as curiosities.

The best-known American species is probably the white, water, or American elm (*U. alba* or *Americana*), which grows in rich moist woods, especially on the shores of streams from Newfoundland to Florida and westward to the eastern side of the Rocky Mountains. It is a tall tree, often attaining a height of 120 feet when growing in the forest, and a wide-spreading, less lofty top when growing in the open, where it may be seen in several different forms, popularly known as vase, plume, oak-tree, etc., according to the arrangement of the branches. Some specimens of each form develop numerous twiggy growths upon the trunk and main branches, which are thus rendered very attractive because of their feathery appearance. The most common form is the vase, in which the main branches develop at about 20 feet or more, and at their bases gradually, and toward their extremities widely diverge. This is probably the most popular street form and species in America. Another well-known American species is the slippery or red elm (*U. fulva* or *rubra*), which attains a height of 70 feet in rich soils and is found from Quebec to Florida and westward to Texas and Dakota. It is called red because the bud scales are reddish and conspicuous when unfolding in spring; and it is called slippery because of its mucilaginous inner bark. Its wood is less valued than that of the English elm, but more than that of the white elm. The cork or rock elm (*U. racemosa*), which grows on river banks from New England to Nebraska and as far south as Kentucky and Tennessee, attains a height of 100 feet and is noted for the corky developments resembling wings on the smaller branches. Its wood is specially valued for its great durability, strength, pliability, and toughness. Another species with corky, winged branches is the Wahoo or winged elm (*U. alata*), which ranges from Virginia to Florida and westward to Texas and Illinois. It rarely exceeds 70 feet in height, is very attractive in habit, and is planted for ornament in the South,

but not in the North, as it is not sufficiently hardy for the rigors of winter.

The most noted European species is the English elm (*U. campestris*), which ranges through middle and southern Europe, northern Africa, and eastward to Japan. It reaches 100 feet in height and has a rather round-topped or open head, on account of its spreading branches. It is frequently planted for ornament at home and abroad, and in America is valued because its foliage continues green for several weeks after that of the white elm. It has several distinct varieties, which are sometimes considered as distinct species, and of which there are a large number of horticultural varieties. The next most important European species is probably the Scotch or wych elm (*U. scabra* or *montana*), which has much the same range as the preceding species, like which it attains a height of about 100 feet. It is a variable species with many cultivated varieties, one of the best known of which is the Camperdown elm, which has long, pendulous branches, on account of which the tree is frequently planted as a curiosity in parks and gardens. The Chinese elm (*U. parvifolia*) is a semi-evergreen shrub or small tree, a native of eastern Asia, which has proved hardy in America as far north as Massachusetts.

Elms are readily propagated from seed which ripens in late spring or early summer and should be sown at once. The seedlings are easily managed, both as to cultivation, transplanting and pruning. The trees do best in rich soil, especially if moist. The choice varieties are generally grafted. The trees, especially of the American or white elm, are specially liable to the attacks of certain insects and diseases, which often defoliate them. The latter may be kept in check by the timely and proper application of a standard fungicide (q.v.).

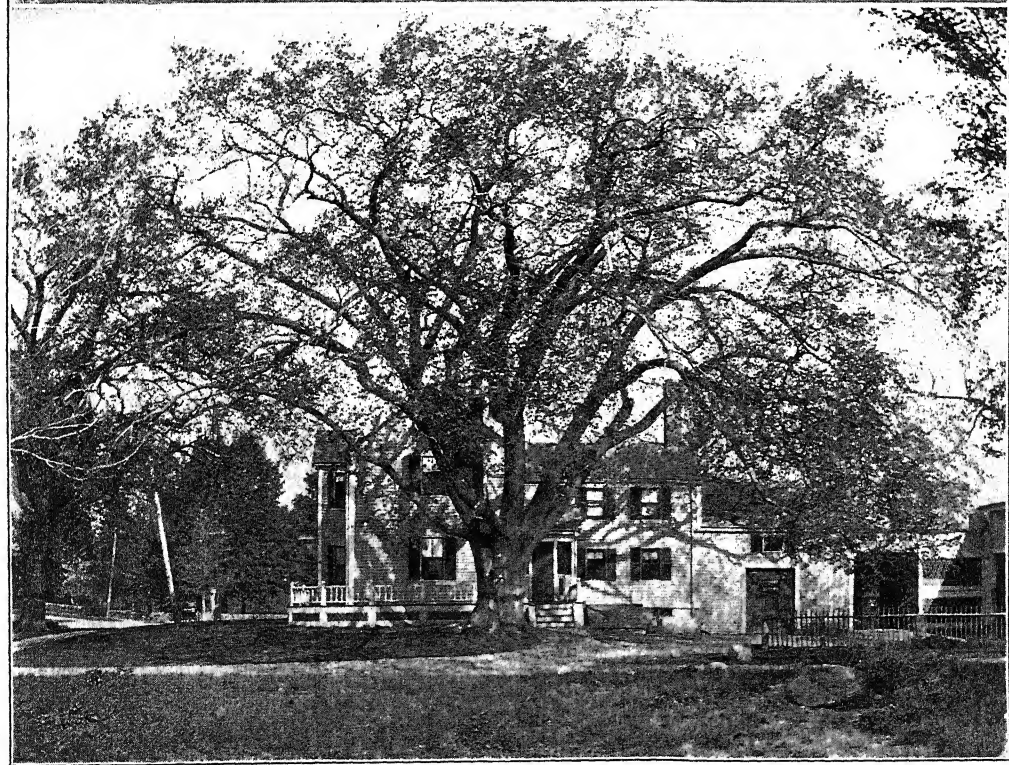
The name elm is also given to various unrelated trees, the best known of which are probably the following: Water elm (*Phanera aquatica*); Spanish elm or Bois-de-Chypre (*Cordia gerascanthus*), and also to *Hamelia verticosa*, both of which species are natives of the West Indies. Several Australian trees are also known as elms, especially *Duboisia myoporioides* and *Aphananthe Philippinensis*, each of which is valued for its timber.

**Elm, Slippery**, in medicine, the bark of *Ulmus fulva*, is widely used as a demulcent. It is probable that the ancient Indian inhabitants of the country introduced it into modern medicine. Slippery elm bark is noted for the large amount of mucilage which it contains, thus rendering it a pleasing demulcent for sore throat, diarrhoea, dysentery, and inflammation of the intestinal tract in general.

**Elm-insects.** Few ornamental trees are more subject to the attacks of insects than are the elms, and especially the American elm. The European species are, however, attractive to the European insects, of which many have been brought over unintentionally, and have spread remarkably because of the absence of their enemies. One of the most notable is the plant-louse known as *Colophia ulmicola*, which produces the cockscomb galls upon the foliage. It is rarely very troublesome, and has usually done its damage before it can be attacked. Kerosene emulsion, if applied in time, will prove



ELM TREES.



FAMOUS NEW ENGLAND ELMS.



effective. (See INSECTICIDE.) A borer (*Saperda tridentata*) is sometimes troublesome, but there seems to be no satisfactory way to control it. Most of the other insects that attack the elms are beetles, their larvæ, or the caterpillars of various moths. These all bite their food, and hence may be attacked with arsenites or other stomach poisons sprayed upon the foliage. Among these insects are the four-horned sphinx-moth (*Ceratomia amyntor* or *quadricornis*), a green caterpillar with four little horns near the head and the long anal horn characteristic of the sphinx-moth. The bag-worm (*Thyridopteryx ephemeraformis*), the gypsy-moth (*Ocnaria dispar*), the tussock-moth (*Notolophus* or *Orgyia leucostigma*), and several other general feeders are frequently troublesome. But the most important leaf-eating enemy of the elm is the elm-leaf beetle (*Galeruca xanthomelana*), a greenish-yellow, two-striped European insect which appears and eats the leaves in spring. The bottle-shaped yellow eggs are laid in rows on the under sides of the leaves, and the hairy, black-spotted, yellow larvæ eat circular holes between the leaf-veins. Spraying with arsenites is effective, but where more than one brood is produced the sprayings must be repeated frequently throughout the summer. Consult Marlatt, 'Elm Leaf Beetle,' Circular 8, Division of Entomology, United States Department of Agriculture.

**Elmer, Horace**, American naval officer: b. Bridgeton, N. J., 1847; d. Brooklyn, N. Y., 27 April 1898. He entered the navy as acting midshipman in September 1861, and reached the rank of commander in 1885. During the winter of 1897-8 he superintended the construction of naval vessels at Cramp's shipyard in Philadelphia. When it became evident that war with Spain would break out, he was ordered to organize the naval force afterward known as the "mosquito fleet" for coast patrol duty.

**Elmina, ɛl-mē'nā**, or **St. George del Mina**, West Africa, a town belonging to Great Britain, formerly the capital of the Dutch settlements on the Gold Coast, five or six miles west of Cape Coast Castle. The Castle of Saint George del Mina was the first European establishment on the coast of Guinea, having been erected by the Portuguese in 1481. Pop. 10,530.

**Elmira, N. Y.**, city, county-seat of Chemung County, on both sides of the Chemung River, and on the Delaware and Lackawanna, the Lehigh Valley, the Northern Central, and the Erie railways; 100 miles southeast of Rochester, 149 miles east-southeast of Buffalo, and 46 miles south-southwest of Ithaca.

**Industries, etc.**—The government census for 1900 records a total of 362 industrial establishments, with a capital of \$7,365,534, the average number of wage-earners being 4,914, with total wages of \$1,965,056. Among the more important establishments are railway car and general construction and repair shops, steel-plate works, boot and shoe manufactories, glass works rolling-mills, fire-engine construction works, boiler and engine shops, lumber and planing mills, sash, door and blind factories, breweries, tobacco warehouses and factories of tobacco products, iron and steel bridge works, dye-works, silk-mills, knitting-mills, and hardwood-finishing works. The district is fertile, and there are also stone-quarries in the vicinity.

**Public Institutions, Buildings, etc.**—Here are located Elmira College (q.v.), a State armory, the State reformatory (see ELMIRA REFORMATORY), the Arnot-Ogden Memorial Hospital, the Steele Memorial Free Library, a Federal government building housing the Federal courts, the post-office, etc., and various charitable institutions. The park system includes Wisner, Riverside, Eldridge, and Hoffman parks. Elmira is finely laid out, and has an excellent water supply, and gas and electric lighting.

**History, Government etc.**—Elmira was permanently settled in 1788, was incorporated as the village of Newtown in 1815, and in 1828 was re-incorporated as the village of Elmira. In 1836 it became the county-seat of Chemung County, and in 1864 obtained its city charter. During the Civil War it was the State recruiting and military rendezvous, and in 1864-5 one of the Federal prisons for Confederate prisoners of war was here situated. Near the present site of Elmira the battle of Newtown was fought, 29 Aug. 1779. General Sullivan, with an American force numbering 5,000, defeating a combined band of Tories and Indians commanded respectively by Sir John Johnson and Joseph Brant (Thayendanegea) and numbering approximately 1,500. The battle-ground is now marked by a memorial to Sullivan. Elmira is governed, under a charter of 1894, by a mayor, who is biennially elected, and a common council, which is unicameral. In addition to the aldermen, who are chosen by wards for terms of two years, the recorder, municipal judge, and 12 supervisors, to act as a county board, are also chosen by popular vote. Pop. (1890) 30,893; (1900) 35,672; (1903 est.) 37,106.

**Elmira, Battle of**, 29 Aug. 1779, in the Revolution. See CHEMUNG, BATTLE OF.

**Elmira College**, an institution for women, located in Elmira, N. Y. It was founded in 1855 under the auspices of the Presbyterian Church, and its course of study from the first demanded as high a grade of work as is usual in first-class colleges. The degrees conferred are bachelor of arts, bachelor of science, bachelor of music, and master of arts.

**Elmira Reformatory**, a State institution, located in Elmira, N. Y. It is a reformatory to which may be sent only men between the ages of 16 and 30 who have not served a period in a State prison. The court of the State of New York, in sentencing a prisoner to this institution, has no authority to limit the time; that is determined by the managers of the institution, and is almost wholly dependent upon the conduct of the prisoner. However, the term of imprisonment shall not, according to the law of the State, "exceed the maximum term provided by law for the crime for which the prisoner was convicted and sentenced." This reformatory, which takes the place of a State prison for male offenders who have not become hardened in crime, has effected a radical change in methods of dealing with the class of law-breakers intended to benefit. (See BROCKWAY, Z. R.) Consult: Winter, 'The Elmira Reformatory'; New York State Laws of 1877, sec. 2, ch. 173.

**Elmo, Ermo, or Erasmus, Saint**, a martyr who suffered death at Formiæ, a town of ancient Italy, during the persecution under Diocletian, in 303. He is considered the patron saint of

sailors, and is usually invoked by Italian sailors during a storm. His feast is kept on June 3.

**Elmo's Fire, Saint**, is the popular name of an electric appearance sometimes seen, especially in southern climates during thunderstorms, of a brush or star of light at the tops of masts, spires, or other pointed objects. It is also observed at the tops of trees, on the manes of horses, and occasionally about human heads. It is similar in kind to the luminous glow seen at the point when a lightning-rod is working imperfectly, or when there is any very rapid production of electricity. The phenomenon, as seen at sea, was woven by the Greeks into the myth of Castor and Pollux, and was regarded as of friendly omen. The name Elmo is by many thought to be a corruption of that of Helena, the sister of Castor and Pollux. Others take it to be a corruption of Saint Erasmus (Italianized, *Ermo, Elmo*), a Syrian bishop and martyr of the 3rd century, who is invoked by Mediterranean sailors during storms. The phenomenon has also been called the fire of Saint Elias, of Saint Clara, of Saint Nicholas, and of Helena, as well as composite, composant or corposant (that is, *corpus sanctum*).

**El'more, Alfred**, Irish artist: b. Clonakilty, Ireland, 18 June 1815; d. London 24 Jan. 1881. He studied at Royal Academy, London, traveled through Europe to Rome, where he lived two years, returned to England 1844, becoming an associate of the Royal Academy 1845, and Royal Academician 1856. Among his works are: 'Martyrdom of Thomas à Becket' (1840), St. Andrew's Church, Dublin; 'The Novice' (1843); 'Rienzi' (1844); 'Death of Robert, King of Naples' (1848); 'Griselda' (1850); 'Charles V. at Yuste' (1856); 'Marie Antoinette in the Temple' (1861); 'Louis XIII. and Louis XIV.' (1870); 'Ophelia' (1875); 'Mary Queen of Scots and Darnley' (1877); 'Pompeii,' 'John Alden and Priscilla' (1878); 'After the Ruin,' and 'Lenore.'

**Elms, City of**, a popular name given to New Haven, Conn.

**Elmshorn, ělmz'hörn**, Germany, town in Sleswick-Holstein, 20 miles northwest of Hamburg, on the railway to Kiel, and on the Krückau, a navigable tributary of the Elbe. It carries on a considerable amount of traffic by land and water, and has manufacturing industries of various kinds, such as leather, boots and shoes, machinery, dyeing, linen- and cotton-weaving, distilling and brewing, etc. Pop. 13,720.

**Elobey (a-lō-bā'ē) Islands**, the name of two small islands off the coast of Guinea, in Africa, both of which belong to Spain. On Elobey Chico, the smaller island, there is a missionary school, and some manufacturing has been begun. Elobey Grande is the larger island. Pop. of both (1901) 350.

**Elocution**, the art of correct speaking or reading in public, including the appropriate use of gestures. Great attention was paid by the ancients to this art as a branch of oratory. The rhetors in Greece had schools in which young men were trained in the correct use of the voice. Many of the Romans were sent to Greece to study and afterward there were similar teachers of elocution and oratory

in Rome. In modern times the stage has fostered the study of elocution and special attention has been given to it in the Paris Conservatoire, where the strictest canons of the art have been maintained. Many colleges have established professorships of elocution, and it is also one of the branches in the curriculum of well-regulated conservatories of music. The tendency of modern teachers is toward greater simplicity and naturalness of gesture and repose of manner than was formerly used. Perhaps the most successful teacher of this century was Delsarte (q.v.), whose theories and practice worked a revolution both in France and other countries. Notable schools of elocution have been established in this country by Charles Wesley Emerson, Franklin H. Sargent, and others. The list of distinguished elocutionists includes the names of Munroe, Riddle, Riley, Powers, and Mackaye. See ORATORY.

**Eloge, ā-lōzh** (French), is a discourse pronounced in public in honor of the memory of an illustrious person recently deceased. In modern times the *éloge* is peculiarly a French institution, and has given rise to a quite distinct species of literature, which, though its style is not the most agreeable, is not altogether without utility, as the best *éloges* frequently contain rapid and summary views of the state of science, art, literature at a particular time, of the works of some distinguished author, the political events of a period, or whatever other theme may be suggested to the orator by the particular career of the subject of his eulogy. The *éloges* of Fontenelle (1731), and of Cuvier (1819), are particularly valuable and interesting. Such summaries, of course, considering the object with which they are made, must be received with great caution, but they frequently convey information not easily accessible in other ways. An *éloge* is pronounced over every member of the French Academy when he dies, as the inaugural discourse of the new member who is chosen to succeed him. The abuses to which this style of composition is liable have given rise to burlesque and satirical *éloges*.

**Elohim, ěl'ō-hīm or ē-lō'hīm** (plural of Eloah), one of the Hebrew names for God, of frequent occurrence in the Bible, especially in those parts of the Pentateuch attributed to the earliest writers in the northern domain of the Semitic race. Elohim is used in speaking both of the true God and of false gods, while Jehovah is confined to the true God. The plural form of Elohim (literally signifying "the great Eloah" or God) has caused a good deal of controversy among critics. By some it has been considered as containing an allusion to the doctrine of the Trinity, others regard it as the plural of excellence, while others hold it as establishing the fact of a primitive polytheism. This word, along with Jehovah, has played a great part in modern criticism. Critics have professed to find in the comparative frequency of the two terms an evidence of the date of the manuscripts in which they occur; but on this controversy we cannot enter. See ELOHIST.

**Elohism, ěl'ō-hist**, also called **Yahwism**, both used in contradistinction to Jehovism (q.v.), one of the Biblical writers, hypothetically assumed to have written part of the Pentateuch, who habitually, if not exclusively, used the

## ELONGATION — ELSINORE

Hebrew name Elohim for God. The Elohist passages in the Old Testament, as determined upon by Biblical scholars, are simple, straightforward, and bear no signs of rhetoric or poetic effort, therein contrasting with the Jehovistic paragraphs. Gen. i. 27 is Elohist; Gen. ii. 21-4 is Jehovistic. See **BIBLE**.

**Elongation**, in astronomy, the angle that measures the apparent distance of two stars as seen from the earth. The term is, however, by usage confined exclusively to the distance of a planet from the sun, and of a satellite from its primary. The greatest elongation of Mercury amounts to about  $28^{\circ} 30'$ ; that of Venus to about  $47^{\circ} 48'$ , and that of the superior planets may have any value up to  $180^{\circ}$ . When two fixed stars or planets are spoken of the word "distance" is employed.

**Elopement**, an act of unlicensed departure, especially when a wife forsakes her husband and flees with a paramour, or when a daughter or ward accepting the protection of a lover leaves her natural or legal guardians. In almost every one of the States, the male principal in an elopement is held guilty of an abduction provided his associate in the act is under age. Marriage, however, checks all consequent criminal proceedings unless the female alleges coercion. All persons guilty of aiding or abetting an elopement of a male with a female are deemed in law accessories, and liable to legal proceedings. Elopers themselves are not safe from arrest, their act coming within the purview of the criminal statutes.

**Elothærium**, an extinct suilline animal of the Oligocene Epoch, remotely related to the hippopotami and pigs. The skull suggests that of the hippopotamus, but it has a narrow elongated muzzle; and the front teeth resemble those of the carnivora rather than the shearing tusks of the hippopotami and pigs. The limbs and feet are tall and stilted, the lateral toes reduced to small rudiments, as in ruminants. Different species ranged in size from that of a sheep to that of a rhinoceros.

**El Petén**, Guatemala, one of the northern departments of the republic; pop. 6,752. Its chief town is Flores; pop. 1,671, and altitude above sea 482 feet.

**Elphinstone, Mountstuart**, East Indian administrator: b. Scotland 6 Oct. 1779; d. Limpsfield, Surrey, 20 Nov. 1859. He joined the Bengal civil service in 1795; was ambassador to the Afghan court in 1808; resident at the court of Poonah from 1810 to 1817; and British commissioner to that province from 1817 to 1819, when he became governor of Bombay. During a government of seven years he established a code of laws, lightened taxes, and paid great attention to schools and public institutions. He resigned in 1827. A college established by the natives was called after him Elphinstone College. He was the author of an 'Account of the Kingdom of Cabul and Its Dependencies' (1815); and a 'History of India' (1841).

**Elphinstone, William**, Scottish prelate: b. Glasgow 1431; d. 25 Oct. 1514. Having gone to France he studied law for three years, and was appointed professor of law, first at Paris and subsequently at Orleans. He was subsequently made commissary of the Lothians, and in 1479 was made archdeacon of Argyle. Soon after he

was made bishop of Ross; and in 1483 was transferred to the see of Aberdeen. In 1488 he was made lord high-chancellor of the kingdom. In October of that year he assisted in the coronation of James IV. He was afterward sent on a mission to Germany, and on his return was installed in the office of lord privy-seal, which he held till his death. In 1494 he obtained a papal bull for the erection of a university at Aberdeen, and King's College and University soon came into existence.

**El Quicke**, Guatemala, one of the northern departments of the republic; pop. 92,753. Its chief town is Santa Cruz; pop. about 12,000 and altitude above sea-level 5,543 feet.

**Elsberg**, *ĕlz'bĕrg*, **Louis**, German-American physician: b. Gerlohn, Prussia, 1836; d. in the United States in 1885. He introduced the art of laryngoscopy in the United States, wrote many papers on the throat and its diseases, notably, 'The Throat and the Production of the Voice'; was the first to illustrate the character of undertones and divisions of sound in articulation, and invented many instruments which are used in surgical treatment of the throat and ear.

**Elsheimer**, *ĕlz'hĭm-ĕr*, **Adam**, German painter: b. Frankfort-on-the-Main 1578; d. probably at Rome 1620, called the "Roman Painter of Germany." He studied in Rome and settled there while still very young. He painted many biblical and mythological scenes and was a master of landscape, being the chief German artist of the end of the 16th century to acclimatize Roman art in Germany. Among his principal works are: 'Jupiter and Mercury with Philimon and Baucis'; 'Joseph in the Pit'; and 'Judith,' at Dresden; 'Martyrdom of St. Lawrence,' and 'Flight into Egypt,' at Munich; his portrait and 'Triumph of Psyche' at Florence; many landscapes at Naples, Venice, and Madrid; 'Good Samaritan,' and another 'Flight into Egypt' at the Louvre, and a large collection of drawings.

**Elsie Venner**, a romance by Oliver Wendell Holmes, first published serially, in 1859-60, under the name of 'The Professor's Story.' It is a study in heredity, introducing a peculiar series of phenomena closely allied to such dualism of nature as may best be described by the word "ophranthropy." Delineations of the characters, social functions, and religious peculiarities of a New England village, form a setting for the story. The victim of some pre-natal casualty, Elsie shows from infancy unmistakable traces of a serpent-nature intermingling with her higher self. This nature dies within her only when she yields to an absorbing love.

**Elsinore**, *ĕl-sĭ-nŏr'*, or **Elsineur** (Danish, Helsingör), Denmark; seaport, on the island of Zealand; 24 miles northeast of Copenhagen. Its inhabitants are engaged chiefly in commerce and seafaring. The castle of Kronborg, built about 1580, is the chief defense of the town. It is a Gothic-Byzantine edifice, built by Frederick II. in the boldest style, and is said to be one of the finest structures of its kind in Europe. It is now chiefly used as a prison, and was the place of confinement of the unfortunate Matilda, sister of George III. of England. The manufactures are chiefly fishing-nets and a coarse cloth. Ship-building has been an important industry. Pop. (1901) 13,902.

**Elson, Henry William**, American author: b. Muskingum County, Ohio, 29 March, 1857. He was educated at Lutheran Theological Seminary, Philadelphia, and the University of Pennsylvania. After occupying two or three Lutheran pastorates he left the ministry and took up the work of writer and lecturer of the University Extension Society of Philadelphia. He has published 'Side Lights on American History' (1899); 'Four Historical Biographies for Children: Andrew Jackson, U. S. Grant, Daniel Boone, and Frances Willard' (1899); 'How to Teach History' (1901), and 'Elson's History of the United States.'

**Elson, Louis Charles**, American writer on music: b. Boston, Mass., 17 April 1848. After studying music at Leipsic he returned to Boston and has been a teacher and lecturer on music there from 1876. He has been musical editor of the *Boston Advertiser* since 1888. He has published 'Curiosities of Music' (1883); 'German Songs and Song Writers' (1886); 'Our National Music and Its Sources' (1886); 'Theory of Music' (1890); 'Realm of Music' (1892); 'European Reminiscences' (1893); 'Great Composers' (1897); 'Shakespeare in Music' (1900); 'Famous Composers and Their Works,' new series (1901).

**Elssler, ěl'z'ler, Fanny**, Austrian dancer: b. Vienna 23 June 1810; d. there 27 Nov. 1884. She was the daughter of Johann Elssler, Haydn's factotum, and was educated at Naples for the ballet, with her elder sister Theresa, who in 1851 became the morganatic wife of Prince Adalbert of Prussia and was ennobled. Fanny Elssler during her visit to the United States gave an entertainment in order to raise money for the Bunker Hill Monument.

**Elster, ěl'stĕr**, two German rivers. (1) The White, or Great Elster, rising in the west of Bohemia, flows north into Saxony, receives the Pleisse and Parde at Leipsic, and joins the Saale between Halle and Merseburg, after a course of about 115 miles. (2) The Black Elster, rising in Saxony, flows north into Prussia, then northwest, receives the Pulsnitz and Röder, and joins the Elbe between Wittenberg and Torgau, after a course of about 130 miles.

**Elstracke, Reginald or Ronald**, English engraver: b. probably in London and lived there early in the 17th century. His plates were made with the graver solely, their chief value being historical. He executed portraits of Mary Queen of Scots, Darnley, and Queen Elizabeth. Among his works was a volume of 32 plates called 'Basiliologia: a Book of Kings, being the true and lively effigies of all our English Kings from the Conquest until this present' (1618).

**Elswick, ěl'z'wik**, England, suburb of Newcastle, containing the great ordnance works of Sir William Armstrong, Mitchell & Company. These works are probably the largest of their kind in Europe, and employ about 14,000 persons. Pop. 51,000.

**El'ton, Charles Isaac**, English jurist and archæologist: b. Somerset 1839; d. Chard, Somerset, 23 April 1900. He was educated at Oxford and was called to the bar in 1865. He represented West Somerset in Parliament as a Conservative 1884-5 and 1886-92. On

legal subjects he published: 'Tenures of Kent' (1867); 'Commons and Waste Lands' (1868); 'Copyholds and Customary Tenures' (1874-93); 'Improvement of Commons Bill' (1876); 'Custom and Tenant-Right' (1882); and 'Robinson on Gavelkind' (1897). Other works of his are: 'Norway, The Road and Fell' (1864); 'The Career of Columbus' (1892); 'The Great Book-Collectors' (1893); and 'Shelley's Visits to France' (1894). His greatest work, however, is his 'Origins of English History' (1882). It is chiefly characterized by its thorough investigation of the evidence furnished by Greek and Roman writers regarding the condition and circumstances of early Britain, by its discussion of the ethnology and prehistoric archæology of the country, and by the importance assigned to the Celtic and even pre-Celtic element in forming the English nation.

**Elton, James Frederick**, English explorer: b. 3 Aug. 1840; d. 13 Dec. 1877. He entered the Indian Army in 1857. In 1871 he found himself in the Transvaal and Natal; in 1873 he was vice-consul at Zanzibar, two years afterward as consul in Mozambique he explored the coast of East Africa for the sake of repressing the slave trade. With Cotterill he reached Lake Nyassa in 1877 and scaled the Konde range of mountains at the north end of the lake, to the height of 10,000 feet. After his death Cotterill published his journal under the title: 'Travels and Researches among the Lakes and Mountains of Eastern and Central Africa.'

**Elton**, a shallow lake in the government of Astrakhan, in Russia; area, 60 square miles. Eight salt-water streams flow into this lake, and it has no visible outlet; thus a large salt deposit rests on the bed of the lake. From about the middle of the 17th century for 100 years, the salt from this lake was in demand; but since the opening of the salt fields in the southern part of Russia (1860) the Elton salt has not been on the market.

**Elvas, ěl'väs** (Rom., ALPESA; Moorish, BALESH), the strongest fortified city of Portugal, in the province of Alemtejo, near the Spanish frontier; 10 miles west of Badajoz. Standing on a hill, it is defended by seven large bastions and two isolated forts. Pop. (1900) 14,018.

**Elves** (O. Eng., *ělf*; Germ. *Alp*; phantom, spirit); imaginary creatures of the northern mythology, forming, according to some classifications, with the undines, salamanders, and gnomes, groups of elementary sprites identified respectively with the water, fire, earth, and air. The elves are of the air, and have been more widely received in the faith and poetry of Europe under this name than under that of sylphs, invented by Paracelsus. They are capricious spirits, of diminutive size but preternatural power. Their stature is less than the size of a young girl's thumb, yet their limbs are most delicately formed, and when they will they can hurl granite blocks, bind the strongest man, or shake a house. They are divided in the sagas into good and bad, or light and dark elves, the former having eyes like the stars, countenances brighter than the sun, and golden yellow hair, the latter being blacker than pitch, and fearfully dangerous. The elves ordinarily wear glass shoes, and a cap with a little bell hanging from it. Whoever finds one of these slippers or bells



may obtain from the elf who has lost it any thing which he asks for. In the winter they retire to the depths of mountains, where they live in much the same way as men, and in the first days of spring issue from their grottoes, run along the sides of hills, and swing upon the branches of the trees. In the morning they sleep in blossoms or watch the people who pass by, but at the evening twilight they meet together in the fields, join hands, and sing and dance by the light of the moon. They are generally invisible, but children born on Sunday can see them, and the elves may extend the privilege to whomsoever they please. In England and Scotland they became fairies in the former, and brownies in the latter country, and were subject to a king and queen. The islands of Stern and Rugen, in the Baltic, are especially subject to the king of the elves, who rides in a chariot drawn by four black horses, and whose passage from island to island is recognized by the neighing of the steeds, the blackness of the water, and the bustle of the great aerial company who follow in his train. The elves sometimes become domestic servants, and would be valuable as such if they were less easily offended and less dangerous after taking offense. As long as their caprices are gratified, their food and drink regularly left at an appointed place, and no attempt made to interfere with their freedom, the furniture is sure to be dusted, the floor to be swept, and every chamber to be perfectly in order. But the brothers Grimm, in their 'Deutsche Sagen,' have chronicled the misfortunes of many a young girl, who, having called an elf to her aid, repented too late of having offended it.

**El'well, Frank Edwin**, American sculptor: b. Concord, Mass., 15 June 1858. He studied at the Ecole des Beaux Arts, Paris, and also under Jean Alexandre Falguiere, and is a member of the Institute of France. Among his works are a monument at Edam, Holland, 'Death of Strength'; statue in Paris of 'Awakening of Egypt'; equestrian statue of Gen. Hancock at Gettysburg; monument to Edwin Booth, Mount Auburn, Cambridge; the two fountains of 'Kronos' and 'Ceres' at the Pan-American Exposition, Buffalo; 'Dickens and Little Nell,' Fairmount Park, Philadelphia; and a bust of Levi P. Morton, Senate chamber, Washington.

**Elwell, James William**, American philanthropist: b. Bath, Me., 27 Aug. 1820; d. Brooklyn, N. Y., 2 Sept. 1899. He became a partner in his father's commission-house in New York in 1838; and after the death of his father founded the firm of James W. Elwell & Company in 1852. The firm owned three lines of vessels to the principal European, southern, West Indian and South American ports. His philanthropic gifts aggregated \$3,000,000, and he bequeathed \$25,000 to his favorite charities. He originated the Helping Hand Society and was one of the founders of the Brooklyn Orphan Asylum. He was also identified as trustee or director with many other charitable institutions.

**El'wood**, Ind., city in Madison County; on the Pittsburgh, C., C. & St. L., and the Lake Erie & W. R.R.'s; about 50 miles northeast of Indianapolis. It is surrounded by an agricultural region, and is in a natural-gas belt. Its industries are chiefly lumber, flour, tin-plate-mills; window, plate glass and lamp chimney

and other factories. Its shipping trade consists in the agricultural products of the surrounding country, and the articles manufactured in the city. Pop. 12,950.

**Ely, Richard Theodore**, American political economist: b. Ripley, N. Y., 13 April 1854. He was graduated from Columbia University in 1876, and studied also at Heidelberg, Germany. He became professor of political economy at Johns Hopkins University in 1881, and professor of political economy and director of the school of economics and political science at the University of Wisconsin in 1892. On account of his advocacy of trade unions, he was accused in 1894 of 'aiding and abetting' a strike, and of being a Socialist, and an attempt was made to force him out of his professorship at the university. A committee of the regents appointed to investigate the matter acquitted him. While he is not a Socialist, he advocates public ownership of 'natural monopolies' and has carefully investigated and stated the aims of the Socialist movement. His works include: 'French and German Socialism in Modern Times' (1883); 'Socialism and Social Reform' (1894); 'Recent American Socialism' (Johns Hopkins University Studies, Vol. III., 1885); 'Problems of To-Day' (1886); 'The Labor Movement in America' (1886); 'Political Economy' (1889); 'Social Aspects of Christianity' (1889); 'Social Law of Service' (1900); 'Monopolies and Trusts' (1900). This last is a small part of a large work, 'The Distribution of Wealth,' which is not completed.

**Ely**, England, an episcopal city, in the county of Cambridge; about 15 miles northeast of Cambridge; on the Ouse. The place is noted for its cathedral, one of the most remarkable edifices of the kind in England. It occupies the site of a monastery founded about the year 673 by Saint Etheldreda (or Audry), daughter of Anna, king of East Anglia. Its ancient history is most interesting. In 1071, Hereward, the noted English outlaw, defended Ely against the Normans. See HEREWARD. Pop. 7,812. Consult: Van Rensselaer, 'English Cathedrals'; F. Bond, 'English Cathedrals'; Stewart, 'Architectural History of Ely Cathedral.'

**Ely**, Isle of, a district in England, in the county of Cambridge, separated on the south by the Ouse from the remaining portion of the county, and forming itself a sort of county; area 227,326 acres. It rises about 100 feet above the general level of the fen country, and was formerly surrounded by marshes, which at times became sheets of water. The whole has by drainage been converted into fertile fields. Pop. (1901) 64,494.

**Elymais**, ēl'-ī-mā'is. See ELAM.

**Elyot**, ēl'-ōt, **Sir Thomas**, English author: b. Wiltshire not later than 1490; d. Carlton, Cambridgeshire, 20 March 1546. In 1511 he became clerk of assize, in 1523 clerk of the king's council. In 1531-2, as ambassador to Charles V., he visited the Low Countries and Germany, having orders to procure, if possible, the arrest of Tyndale. 'The Boke named the Gouernour, devised by Sir Thomas Elyot, Knight,' was published in 1531. It may be described as the earliest treatise on moral philosophy in the English language, the author's principal object being "to instruct men in such vertues as shall

be expedient for them which shall have authority in a weale publike." An elaborate 10th edition appeared in 1880, with life notes and glossary by H. H. S. Croft. Elyot's 12 other works include: 'Of the Knowledge which maketh a Wise Man' (1533); 'Pasquil the Playne' (1533); 'Isocrates' 'Doctrinal of Princes' (1534); 'Picus de Mirandola's 'Rules of a Christian Lyfe' (1534); 'The Castel of Helth' (1534); 'The Bankette of Sapience' (1534); 'Bibliotheca' (1538), the first Latin-English dictionary; 'The Image of Governance' (1540); 'Defence of Good Women' (1545); and 'Preservative against Deth' (1545). These books went through edition after edition in their author's lifetime, and have now become among the rarest treasures of the bibliomaniac.

**Elyria**, Ohio, city, county-seat of Lorain County; on the Black River; and on the Cleveland, L. & W., and the Lake Shore & M. S. R.R.'s; 25 miles southwest of Cleveland. Agriculture is the chief industry of the surrounding country; the sandstone quarries furnish employment to a number of people. The chief manufactures in the city are supplies for automobiles and bicycles, saddles, and iron and steel products. Pop. 8,112.

**Elysée**, Palais de l', pǎ-lǎ dè lǎ-lè-zǎ, the official residence of the president of France, in Paris, on the Rue du Faubourg St. Honore, with its garden extending to the Champs Elysees. It was built in 1718 for the Count d'Evreux; in the reign of Louis XV. it became state property, and was the residence of Madame de Pompadour. It was also used as a residence by Napoleon I., and by Louis Napoleon, and became the presidential residence in 1871.

**Elysian Fields**, or Elysium, in classical mythology, the residence of the blessed after death. Elysium was supposed by Homer to have been at the western end of the earth; other poets placed it in the Fortunate Isles; later it was supposed to be in the under world. It was represented as a region of perfect happiness, where the sky was always cloudless, and a celestial light shed a magic brilliancy over every object; where each one was free to follow his favorite pursuit, and cares and infirmities were unknown.

**Elze**, ěl'tsě, Karl, German historian of literature: b. Dessau 22 May 1821; d. Halle 22 Jan. 1889. His specialty was English literature, and he was professor of English philology in the University of Halle 1875-89. One of his first works was a compilation entitled a 'Treasury of English Song.' He produced critical editions of Shakespeare and other English dramatists, and wrote biographies of Byron and other English authors. Specially noteworthy is his 'Outline of English Philology.' 'Westward' (1860) contains translations of English and American poems.

**Elzevir**, ěl'zě vřr, name of a notable family of printers descended from Ludovic Elsevier or Elzevier, Latinized Elzevierius, a native of Louvain: b. 1540. Having learned the bookbinders' trade, he practised it for some years in his native town, but 1580 he removed to Leyden in the United Provinces, and there set up a printing press. His five sons, Matthew, Ludovic, Egidy, Joost, and Bonaventura, were also printers and booksellers; but it was the youngest of the five, Bonaventura, born 1583 at Leyden,

that gave the name Elzevir its great celebrity. The first work published by the house of Elzevir appeared in 1583, the 'Ebraicæ Quæstiones et Responsiones' of Drusius, not the whole three books, but only the second and third. In 1608, nine years before his father's death, Bonaventura Elzevir founded a separate printing and publishing establishment in the same city, and then commenced the issue of works in Greek, Latin, and other languages which have ever since been regarded as models of correct and elegant typography. He conducted the business of his house more than 42 years, till his death in 1652, having had as partner from 1626 Abraham Elzevir, his nephew, whom he survived one month. He was succeeded by his son Daniel and Abraham's son John: this partnership was soon dissolved, John carrying on the business in Leyden, Daniel migrating to Amsterdam in 1655 and entering into partnership there with another of his cousins: both of these were dead 1680. The last of the Elzevirs to figure in the history of typography was Abraham, son of Abraham, one of the five sons of Ludovicus: from 1681 to 1712 he was printer to the University of Leyden. The Elzevir editions of the ancient classics, especially Latin, while admirable in point of typography, are mostly reproductions of the texts adopted by previous printers and hence are inferior from the critical point of view. The number of works published by the different Elzevir houses number 1,213, namely, Latin 968; Greek 44; French 126; Flemish 32; Oriental 22; German 11; Italian 10.

**Emancipation**, the act by which freedom of various kinds is granted to individuals, races, or nations. In Roman law the dissolution of paternal authority (*patria potestas*) in the lifetime of the father. It took place in the form of a sale by the father of the son to a third party, who manumitted him. The Twelve Tables, the foundation of Roman law, required that this ceremony should be gone through three times. In general, the son was at last resold to the father, who manumitted him, and thus acquired the rights of a patron which would otherwise have belonged to the alien purchaser who finally manumitted him. In the case of daughters and grandchildren one sale was sufficient. The Catholic Emancipation Act was the act signed 13 April 1829, which removed the most galling of the Roman Catholic disabilities in England. See CATHOLIC EMANCIPATION; EMANCIPATION PROCLAMATION; SLAVERY.

**Emancipation, Catholic**, the customary designation of a measure of relief from penalties and civil disabilities granted to professors of the Catholic religion in England and Ireland by acts of the British Parliament 1829: the act did not extend to Scotland. The necessity of granting relief to the Catholics of Ireland became apparent soon after the outbreak of the war against the American colonies, and the first relaxation of the penal laws against the professors of the Catholic religion was made in 1780. At that time it was high treason for a priest, native of the kingdom, to perform any of the duties of his office. Catholics could not own land in fee. Roman Catholics whose titles to land antedated the penal laws were ousted if the legal heir professed Protestantism. A Catholic could not practise law, nor conduct a school. In 1780 a bill for removal of some of the disabilities was

## EMANCIPATION IN LATIN-AMERICA

passed for England and Ireland. When the act of union of the kingdom of Ireland with that of Great Britain was passed in the Irish Parliament 1800, solemn pledges were given by the British Cabinet that the disqualifying statutes should be repealed; but after the union the promise was ignored. In 1824 in Ireland was formed the Catholic Association to agitate for civil rights, such as the right to vote for members of the Parliament, to be elected members of the same, and to occupy various offices in the government, national and local. In 1829 it was seen by English statesmen that to withhold these rights and franchises any longer would provoke a rebellion in Ireland; and a bill of relief was introduced in the Parliament 5 March, and passed in both houses and approved by King George IV. 13 April, permitting Catholics to elect and be elected to the Parliament, and to hold offices under the Crown; but they remained still expressly excluded from certain high offices—that of lieutenant-governor of Ireland, that of regent of the universal kingdom, of lord chancellor of the United Kingdom, or of Ireland, etc. In 1867 the last named disability was removed, as was, many years after, the disability of a Catholic to be lord chancellor of the United Kingdom. But the Act of Grace of 1829 contained a clause forbidding Catholic ecclesiastics, monks, friars, and nuns from wearing the attire or habit of their respective station or order in public under a penalty of \$250 for each offense. This proviso was ostentatiously violated in Ireland, and with impunity, for, like the \$500 forfeiture for violation of the Ecclesiastical Titles Acts (q.v.), no penalty was ever exacted. Another clause of the Catholic Emancipation Act, which was also ignored and condemned, required that Jesuits and members of religious orders of the Roman Catholic Church living within the kingdom should register in the office of the clerk of the peace of the county under a penalty of \$250. See O'CONNELL, DANIEL. Consult: Butler, 'Historical Memoirs'; Milner, 'Supplementary Memoirs'; Lingard, 'History of the Church in England'; Green, 'History of England.'

**Emancipation in Latin-America:** the Manumission of Slaves in Relation to the several Declarations of Independence. In Haiti, where African slavery was first introduced into America, the negroes received as a gift "the full liberty, equality, and fraternity" of the French republic in 1794, and by fighting established their independence in 1804. In Central America (when Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica were united in the Central American republic), the laws of 31 Dec. 1823 and 17 and 24 April 1824 emancipated all slaves, and made free slaves of other countries coming to Central America. The slave trade was prohibited, under penalty of forfeiture of the rights of citizenship. H. H. Bancroft, in his 'History of the Pacific States,' says: "Of all the nations of North America, to the Central American republic belongs the honor of having first practically abolished slavery." We shall presently show, however, that this distinction fairly belongs to Mexico. Ecuador, which made its first effort to gain independence at Quito, 10 Aug. 1809, and actually threw off the yoke of Spain on 9 Oct. 1820, abolished slavery during the presidential term of Gen. Urvina, 1852-6. The Argentine nation began its struggle for independence 25

May 1810, and at the congress of Tucuman, 9 July 1816, the formal separation from Spain was declared. Article XV. of the Constitution of 25 Sept. 1860 provides that "there shall be no slaves in the Argentine nation. Those few who now exist in it shall become free at the very moment this constitution goes into effect. The indemnifications which this declaration may involve shall be provided for by special law. Any contract involving the purchase or sale of a person shall be held to be a criminal offense.

Slaves introduced in any way whatever into the country shall become free by virtue of the fact that they have trodden the soil of the republic." In Colombia (New Granada) the number of negroes was never very great; it was estimated at 80,000 in the middle of the 19th century. The struggle for independence, beginning 20 July 1810, or as a vigorous insurrection in 1811, was continued after the union with Venezuela (December 1819), and the republic of New Granada was formed in 1831. In 1821 a law was passed by the republic of Colombia for the gradual manumission of slaves, and all born after that date were declared free at the age of 18,—that gradual process applying, of course, to all the territory of the Greater Colombia at the time of the law's enactment. (See *COLOMBIA, History*.) A law of 1851 abolished slavery entirely in New Granada, by giving liberty to all who remained slaves on 1 Jan. 1852, provision being made for the payment of indemnity to the owners. The beginning of the war for independence in Mexico dates from 16 Sept. 1810 (see *DOLORES, EL GRITO DE*); on 6 Nov. 1813 the first Mexican congress, installed in the town of Chilpancingo, issued the declaration of independence and decreed the emancipation of slaves. This, therefore, was the starting point of emancipation on the mainland of America. Venezuela's declaration of independence (5 July 1811) was followed after 10 years by the law for the gradual manumission of slaves which we have mentioned above, that is, the law of the Greater Colombia of 1821. Paraguayan independence should be dated from 11 June 1811, when an assembly of deputies began its sessions; for the resolution passed by this assembly, renouncing allegiance to Spain, was ratified as a declaration of independence by the Paraguayan congress of 1 Oct. 1813. The question of African slavery was comparatively unimportant in Paraguay. "In 1865 there were negroes and mulattoes at Emboscada, Tabapy, and Aregui; but the negroes have now almost completely disappeared" ('Handbook of Paraguay,' September 1902, issued by International Bureau of the American Republics). Chile entered upon a contest with Spain on 18 Sept. 1810, and the independence of the country was proclaimed 12 Feb. 1818. The negro problem did not weigh upon that country, the population being recruited from Europe quite largely. The independence of Peru was declared at Lima 28 July 1821; that of the Dominican republic 1 Dec. 1821; that of Brazil 7 Sept. 1822; and Bolivia became an independent republic 6 Aug. 1825. In Brazil the conservative statesman, Silva Paranhos, obtained from the parliament the passage of a bill (28 Sept. 1871) for the gradual extinction of slavery, which provided that thereafter every child born of a slave mother should be free, and created a special fund for emanci-

## EMANCIPATION PROCLAMATION

pation by redemption. Private philanthropy, largely directed by the Masonic lodges, effected more than the fund created for this purpose; and the number of slaves began to decrease. A bill for the immediate and unconditional abolition of slavery in Brazil was signed by Princess Regent Isabel 13 May 1888; the monarchy was overthrown 15 Nov. 1889; the new Constitution approved 24 Feb. 1891. In Cuba the slaves were emancipated on the conclusion of the Ten Years' War, that is, in 1878, and Cuba became a republic 20 May 1902. The experiences of the French, Danish, and British possessions may be referred to briefly in conclusion. Napoleon restored slavery in French Guiana, Martinique, and Guadeloupe, although his efforts to accomplish the same result in Haiti were, as mentioned above, frustrated by the resistance of the blacks themselves. The freedom of all who were held in bondage throughout the French dominions was declared in 1848. Slavery in the Danish West Indies (St. Thomas, etc.) was abolished also in 1848. The act to abolish slavery throughout the British colonies, providing £20,000,000 for compensation of the owners, was dated 28 Aug. 1833, and its effect was to free 770,280 slaves on 1 Aug. 1834, the number thus emancipated in Jamaica being 309,000.

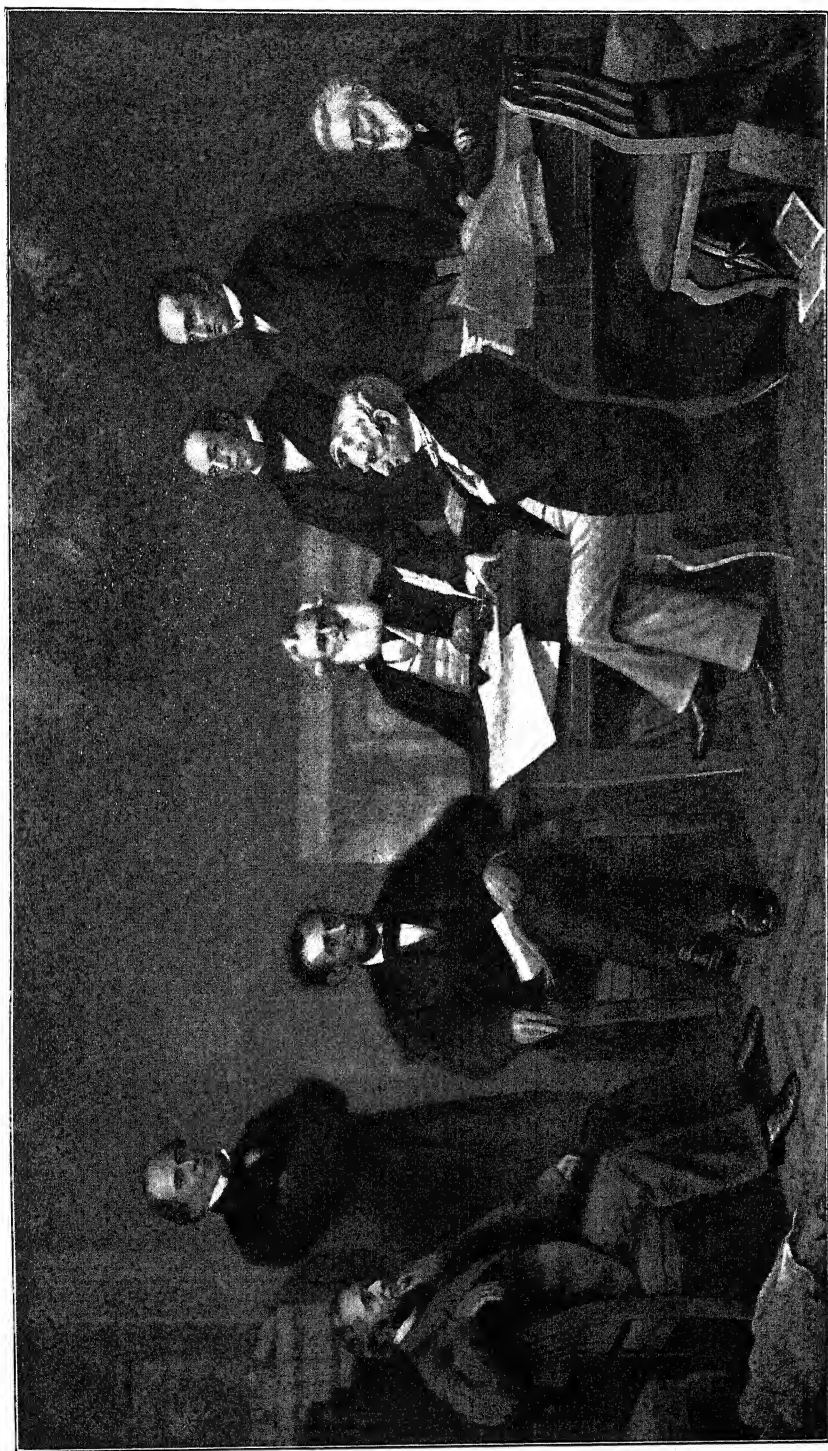
MARRION WILCOX.

**Emancipation Proclamation, 1 Jan. 1863.** The Republican administration at the outbreak of the Civil War was awkwardly placed for dealing with slavery. To assail it in its own territory was not only to belie the past professions of the party, but to alienate so much Northern support as to assure failure; nor indeed had the great bulk of the party any thought beyond fettering the slave power for future aggression. On the other hand, to leave slavery untouched was not only to chill the energies of the most reliable upholders of the War, but to give foreign countries a pretext for asserting that the North was fighting merely for dominion, and that the Southern cause was that of liberty and morally entitled to help. The former horn of the dilemma was much the sharpest; and the government moved very cautiously, restraining its subordinates like Fremont (30 Aug. 1861) and Hunter (9 May 1862) from forcing its hand by emancipation orders. On 9 Aug. 1861 an act had declared masters employing slaves against the government barred from further claim to them; but that was a mere warning and rule of court. The first embarrassing problem was how to deal with slaves in conquered districts, or who had come within its lines: was the government to act as slaveholders' trustee and return them to servitude? The growing resentment against slavery as a convertible term for the rebellion, and disgust at being slave-catchers to the behoof of their enemies, supplied the answer, and on 13 March 1862 all army officers were forbidden to return fugitive slaves; their surrender from any quarter was made harder (though the fugitive-slave law was not formally abolished till 28 June 1864); on 17 June 1862 all captured, deserted, or fugitive slaves of owners in rebellion were freed. As to the main body, who plainly could not be left in unchanged status as the core of a fresh abscess, Lincoln's wish was for compensated emancipation; he sent a special message to Congress 6 March, and that body passed a joint resolution 10 April, declar-

ing that the United States ought to co-operate with any State which would adopt gradual abolition, by paying for the slaves, and on 16 April those in the District of Columbia were thus emancipated; but despite his repeated urgencies, the border States would take no measures of the kind. On 19 June the slaves in the Territories were freed.

The final blow came, as John Quincy Adams 20 years before had forecast that it would, by using the President's war power to suppress insurrection. As the second year of the conflict wore on, the majority demanded the crippling of its enemy by the most efficient means, and very many believed that a threat of general emancipation would bring about a general surrender. Lincoln wished for a great victory first, that it might not appear the selfish resource of an over-matched power; but the discouraging Peninsular campaign obliged him to satisfy his supporters by holding this bludgeon over the enemy. On 22 Sept. 1862 he issued a proclamation announcing that 100 days after, on 1 Jan. 1863, the Executive would issue another proclamation designating the States or parts of States then deemed in rebellion, evidence to the contrary being the presence of *bona fide* representatives in Congress, that all slaves in the designated sections should be permanently free, and that the civil and military authorities of the United States would maintain their freedom, and would not repress any effort of theirs to make it good. The only result was a retaliatory proclamation by Jefferson Davis 23 December, ordering that captured negro Federal soldiers and their officers should be turned over to the States, and that Gen. B. F. Butler should be hanged if captured. On the 1st of January the threatened proclamation was issued, as "by virtue of the power in me vested as commander-in-chief of the army and navy of the United States, and as a fit and necessary war measure for repressing said rebellion." It designated Arkansas, Texas, Louisiana except 13 "parishes" or counties, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, and Virginia except West Virginia and seven other counties, as in rebellion, emancipated all the slaves in them; enjoined these freedmen to abstain from all violence except in self-defense, and to work faithfully for reasonable wages; announced that suitable members of them would be received into United States military and naval service, and for this act invoked "the considerate judgment of mankind and the gracious favor of Almighty God."

The curious feature of this proclamation is that it abolished slavery only in the sections not under the military power of the United States, and left it untouched in those which were, namely, the ones specially excepted by it, "which are, for the present, left precisely as if this proclamation were not issued." Hence it was argued by the Democrats that it had no legal force whatever, and emancipated no one; a question the Supreme Court never passed on. It was always accepted by the majority party, however, as a continuing act, applying as fast as any of that territory fell into the Union power, and not necessary to repeat. Politically, the results were enormous. Recognition of the Confederacy thenceforward meaning a flat maintenance of slavery instead of freedom, the entire anti-slavery sentiment of France and Great Britain was thrown against those countries' interference, which at once be-



FROM THE PAINTING BY CARPENTER.

SIGNING THE EMANCIPATION PROCLAMATION.





came unthinkable. It drove away many lukewarm northern Republicans, and brought many local and State defeats to the administration; but it took the party "off the fence," and made it a coherent organization with one firm, open principle, for many years unassailable. In the South, as defeat meant emancipation by their enemies and it would be no worse if done by themselves, some of the leaders (as Lee) seriously thought of offering freedom to slaves to fight in their armies in the latter part of the War, hoping to save independence and the control of their own destinies at least.

**Emants**, ěm'ants, **Marcellus**, Dutch poet and descriptive writer: b. Voorburg, near The Hague, 12 Aug. 1848. His volumes of travels display his keen observation and his poetical imagination. Among his best are: 'A Journey Through Sweden' (1877); 'Monaco' (1878); 'Along the Nile' (1884); 'From Spain' (1886). He holds a permanent place in the literature of the Low Countries through his charming narrative poems, 'Lilith' (1879); 'The Shimmer of the Gods' (1883).

**Eman'uel the Great**, king of Portugal: b. 31 May 1469; d. Lisbon 13 Dec. 1521. He ascended the throne in 1495. During his reign were performed the voyages of discovery of Vasco da Gama, of Cabral, of Americus Vesputius, and the heroic exploits of Albuquerque, by whose exertions a passage was found to the East Indies (for which the way was prepared by the discovery of the Cape of Good Hope in 1486 by Bartolomeo Dias), the Portuguese dominion in Goa was established, the Brazils, the Moluccas, etc., were discovered. The commerce of Portugal, under Emanuel, was more prosperous than at any former period. The treasures of America flowed into Lisbon, and the reign of Emanuel was justly called "the golden age of Portugal." He died deeply lamented by his subjects, but hated by the Moors and the Jews, whom he had expelled. As a monument of his discoveries, Emanuel built the monastery at Belem, where he was buried. He was a friend to the sciences, and to learned men. He left 'Memoirs on the Indies.'

**Emba**, ěm'bā, a river in the district of Orenburg, Asiatic Russia; the Russians call it Jemba, the Kirghiz, Dchem. It rises at three sources in the western slope of the Mugodchar foothills; flows sluggishly through an area of steppes, is about 200 feet wide and 500 miles long, and forms a delta at its embouchure in the Caspian. It is not navigable, but abounds in fish. The fortress Embinsk is built on its upper waters.

**Embalming**, the act of preserving the body after death. It was probably invented by the Egyptians, whose bodies thus prepared for preservation are known as mummies, but it also prevailed among the Assyrians, Scythians and Persians. It is at least as old as 4000 B.C. The Egyptian mummies were placed in costly coffins ready for sepulture; but were frequently kept some time before being buried—often at home—and even produced at entertainments, to recall to the guests the transient lot of humanity. The usual method of embalming among the ancients was as follows: The intestines and brains were taken out, and the cavities filled up with a mixture of balsamic herbs, myrrh, etc.; the arteries and other vessels were injected with balsams.

The ancient Egyptians filled the cavities of the trunk with aromatic, saline, and bituminous stuff. The cloths in which the mummies were swathed were saturated with similar substances. So effectual were some of the processes that, after 2,000 or 3,000 years, the soles of the feet are still elastic and soft to the touch. By 700 A.D., when embalming practically ceased in Egypt, probably 730,000,000 bodies had been thus treated; many millions of them are still concealed. In 1881 upward of 30 mummies of potentates, including that of Rameses II., were discovered together at Deir-el-Bahari. (See MUMMY.) The Persians employed wax for embalming; the Assyrians, honey; the Jews aloes and spices. Alexander the Great was preserved in wax and honey. Desiccated bodies, preserved by atmospheric or other influence for centuries, have been found in France, Sicily, England, and America, especially in Central America and Peru. The art of embalming was probably never wholly lost in Europe. The body of Edward I., buried in Westminster Abbey in 1307, was found entire in 1770. The body of Canute, who died in 1036, was found very fresh in Winchester Cathedral in 1776. The bodies of William the Conqueror and of Matilda, his wife, were found entire at Caen in the 16th century.

Chaussier's discovery, in 1800, of the preservative power of corrosive sublimate, by which animal matter becomes rigid, hard and grayish, introduced new means of embalming; but, owing to the desiccation, the features do not retain their shape. The discovery of the preservative power of a mixture of equal parts of acetate and chloride of alumina, or of sulphate of alumina, by Gannal, in 1834, and of arsenic by Tranchini, pyroxilic spirits by Babington and Rees in 1839, and of the antiseptic nature of chloride of zinc, have led to the application of these salts to the embalming of bodies required to be preserved for a limited time. The latest method common in the United States is an injection of a fluid into the femoral artery and the cavity of the abdomen. The most efficient agents are mercuric chloride, arsenic and zinc chloride.

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**Embankment**, a mound of earth, thrown up either for the purpose of forming a roadway at a level different from that of the natural surface of the ground, or for keeping a large body of water within certain limits. The slopes should be adapted to the material, so as to secure permanence. To prevent subsidence on marshy or peaty soils, either the weight of the heart of the embankment is diminished, as in Holland, by introducing layers of reeds, or fascines, or artificial foundations are prepared. The embankment may be prevented from slipping laterally by forming steps in the earth of the subsoil, or by cutting deep trenches at the feet of the slopes. In cases where embankments are raised for the storage of water, a "puddle-dike," that is, a water-tight wall, must be inserted through the whole depth of the bank down to the impermeable strata beneath. To resist the action of wind and rain, or of the waters of a slow-flowing stream, the banks should in all possible cases be covered with turf. When embankments are raised at right angles to the current of a river they are called dams.

## EMBARGO — EMBER-DAYS

When they run parallel to the current, and prevent its lateral overflow they are styled levees. Among the largest embankments hitherto executed are those on the banks of the Po, the Meuse, the Scheldt, the Mississippi, United States, on the shores of the Netherlands, and the Croton dam at the head of the reservoir for the supply of water to New York, the Oberhäuser embankment on the Augsburg & Lindau Railway, the Gadelbach cutting on the Ulm & Augsburg Line, and the Tring cutting on the North-western Railway (England). See **LEVEES**; **RESERVOIRS**.

**Embargo in the United States.** Prohibition of foreign commerce, to distress foreign countries and obtain the revocation of hostile measures; "peaceful war," intended to be cheaper than actual warfare and equally efficient, but in fact injuring ourselves deeply and the others little, and ending in real war at last. Our embargos belong exclusively to the French-English wars of 1794-1814. Their ultimate cause was that the agricultural classes, who controlled the administration, did not believe in commerce, and preferred abolishing it to spending anything for its protection; moreover, they were mainly southern and democratic, the commercial interests mainly New England and Federalist, and the former were not loth to spare themselves the cost of war by impoverishing the latter. The first embargo was for 60 days, due to mutual orders of France and England for seizure of neutrals which placed the United States between hammer and anvil. Jay's Treaty (q.v.) of 19 Nov. 1794, for 12 years measurably protected our commerce, but near its end conditions became infinitely worse. In 1806-7 the thronging mutual blows of England and Napoleon, ending in the former's Orders in Council of 11 November, and the latter's Milan Decree of 7 Dec. 1807, made practically every neutral vessel good prize to one or the other. Even more intolerable were the rights of search and impressment claimed by Great Britain, which swept several hundred American sailors every year into the British fleets, and in one massacre (see **CHESAPEAKE AND LEOPARD**) outraged and humiliated this country beyond forgiveness. But aside from the reasons above given, few landsmen believed till the victory of Old Ironsides (see **CONSTITUTION, THE**) that American ships could fight English on equal terms, and it was the general conviction that in case of war our entire fleet would at once be "Copenhagenized" (that is, captured bodily and added to the British fleet, as was the Danish). At Jefferson's recommendation, therefore, "The Embargo" was passed 22 Dec. 1807, forbidding all foreign commerce till the obnoxious decrees were repealed. The havoc not only in trade but in the interior life of the people was terrific: the exports fell from \$110,084,207 in 1807 to \$22,430,960 in 1808. The farming sections were dismayed to find that commerce meant part of their daily bread as well as the carriers' profits, and that they raised and sold much of that \$87,000,000; but they clung all the more stubbornly to their anti-war recipe, though England and France approved it highly. Napoleon was glad to see his enemy drifting into war with a western power; England was glad to regain her carrying trade, and see Canada and Nova Scotia receive American capital. Meantime New England fought it with the fierceness of a struggle for life; evaded it largely by sea, and

sent armies of smugglers overland to Canada. Congress then extended the act to rivers, lakes, and bays, and allowed collectors to seize on suspicion; and the next Congress, 9 Jan. 1809, passed a savage enforcing act with all the fury of baffled doctrinaires, imposing enormous fines, forfeitures, and bonds, and making the collectors supreme despots of their districts. New England was nearly in insurrection; the collectors were in danger of the fate of those under the Stamp Act, some resigned, others were sued in the State courts; the judges would give no findings against smugglers; finally the States threatened nullification, and John Quincy Adams (a victim to its support) declared that they had resolved to withdraw from the Union, at least temporarily, if force were used, and had opened negotiations with Great Britain. A Federalist declared in the Senate that blood would flow. The Democrats were frightened, and hastily fixed (3 Feb. 1809) 4 March for its discontinuance. But the next month they had regained courage, and passed a "non-intercourse act" to take its place; still prohibiting intercourse with France or Great Britain, but restoring it with other countries and allowing free coasting trade. This policy was continued till the War of 1812 opened. The hostility of New England to the war, only less destructive than the embargo and against her political feelings, induced the British government ostentatiously to relieve that section from the blockade, to sow discord and make a base of naval supplies; and on 17 Dec. 1813 a new embargo was laid to 1 Jan. 1815, which, however, was repealed 14 April 1814. Jefferson always asserted that the policy was the best, and the embargo would have accomplished its object if New England would only have helped. (Histories of the United States through this period, as Schouler, McMaster, etc.; especially Henry Adams' 'History,' covering 1801-15, devoted to the causes and consequences of these measures.

**Em'bassy** (*ambassy*, from O. Fr. *ambassée*, from low Lat. *ambachus*, a servant, vassal) in its strict sense, signifies a mission presided over by an ambassador, that is, a diplomatic agent of the first rank, as distinguished from a legation or mission entrusted to an envoy or agent. The difference between the powers and privileges of an ambassador and an envoy is, that the former, as the representative of the person of his sovereign, can demand a private audience of the sovereign to whom he is accredited, while the latter must communicate with the minister for foreign affairs. See **DIPLOMACY**.

**Ember-days**, called in the Roman Missal and Breviary *Quattuor Tempora* (the four seasons) and in the Anglican 'Book of Common Prayer' "Ember-days at the four seasons," are in the Roman and in the Anglican calendar the Wednesdays, Fridays, and Saturdays which come next after 13 December, the first Sunday of Lent, the Feast of Pentecost (Whitsunday), and 14 September, respectively. In both the Latin Church and the Anglican these days are days of fasting. The *Quattuor Tempora* were observed at Rome in the time of St. Augustine (the bishop of Hippo, early in the 5th century), and doubtless the observance was already of ancient date. The custom was brought into Britain by that other St. Augustine who was the herald of the gospel to the Anglo-Saxons. It was anciently the custom for bishops to hold

ordinations only on the Saturdays of the *Quatuor Tempora*. The origin of the phrase Embur-days cannot be definitely ascertained; but it is probably a corruption of *Quatuor Tempora*, as in German *Die Quatember* signifies the Embur-weeks.

**Ember**, or **Immer Goose**, the name in northern Scotland of the loon (q.v.).

**Embezzlement** (O. Fr. *besiler*, to rifle, lay waste) is the appropriation, by a clerk or servant, of money or property put into his hands for trust. Embezzlement is both a theft and a breach of trust; yet, by the general law, it is only a ground for an action for the value of the property. It must not be confounded with larceny, which is "the felonious taking and carrying away the personal property of another." This "taking" implies a trespass, not to be chargeable in embezzlement, which is an offense or form of crime invented by the English statute, which the United States copied and which changed what was not larcenous into a punishable crime, being the act of fraudulently appropriating to personal use money or property held under a fiduciary relation. This crime in the United States is very severely punished as a felony.

**Em'blements** (O. Fr. *emblacement*, from *emblaer*, to sow with grain), a term applied to the growing crops of land when the lease of a tenant for life has expired by the death of the tenant, or when an estate at will has been determined by the lessor. In either case the emblements belong to the tenant or his executors. But when the tenant puts an end to his occupation by his own voluntary act, he will not be entitled to the crops.

**Embolism**, *ëm'bō-lizm* (Gr. *εμβολισμος*, intercalation, *ev*, in, and *βάλλειν*, to cast). In the calendar, an intercalation of a day, as in the second month of our year in leap-year, or of a lunar month, 28 days, in the Greek calendar. In medicine, the blocking up of a blood-vessel by a clot of blood that comes from some distance till it reaches a vessel too small to permit its onward progress. This is often the cause of sudden paralysis and death, or of gangrene and pyæmia.

**Embos'sing** (Fr. *bosse*, a protuberance), the art of producing raised figures upon plane surfaces, such as on leather for bookbinding, etc.; on paper, wood, or bronze. In architecture or sculpture, in proportion as the figures are more or less prominent, they are said to be in *alto*, *mezzo*, or *basso rilievo* (high, half, or low relief). Leather, paper, and textile fabrics are embossed by powerful presses furnished with dies of the desired pattern.

**Embra'cery** (O. Fr. *embraser*, to set on fire), an attempt to corrupt or influence a jury by money, promises, letters, threats, or persuasions. This offense in the United States is punished by fine and imprisonment.

**Embrasure**, *ëm-brä'zür*, in fortification, an opening made in the breastwork or parapet of a battery or fortress, to admit of a gun being fired through it. See **FORTIFICATION**.

**Embree**, **Charles Fleming**, American author: b. Princeton, Ind., 1 Oct. 1874. He is the author of 'For Love of Tonita' (1897); and 'A Dream of a Throne' (1900); 'Heart of Flame.'

**Embro**, a corrupted form of the name Edinburgh. See **EDINBURGH**.

**Embroidery**, the art of producing ornamental patterns by means of needlework on textile fabrics, leather, and other materials. It is closely allied to tapestry, from which, however, it must be distinguished. The essential distinction is that in tapestry work the basis is a series of parallel strings, forming a warp, and the patterns are produced by the manipulation of the threads which form the weft, while embroidery is always worked on an already complete fabric.

The art of embroidery is practised, with characteristic variations, by the rudest tribes, and was well known in very early times. Remains of Egyptian embroidery as ancient as the days of Jacob exist still; and the costumes painted on the monuments of the 18th dynasty show that the most varied patterns were used by the Egyptians 3,000 years ago. The Jews probably acquired the art in Egypt; the description of the curtains of the tabernacle and the garments of Aaron (Exodus xxvi., 1-31, and xxxix.) and other allusions in the Scriptures indicate that their skill in the art was considerable. The knowledge of artistic embroidery came to Europe from the East, where it had its early home, and where it is still most largely practised. To the Greeks and Romans it came from Phrygia, whence at Rome the embroiderer was known as *phrygio*, and embroidered work was called *phrygium*. Frequent references to embroidery are found in Homer, and all later classical writers. It was in mediæval times that the embroiderer's art attained its greatest perfection in Europe, and embroidery was a favorite occupation of women of all ranks. Not only was figure and portrait embroidery highly developed, but, in France especially, much attention was paid to the use of floral and arabesque ornament. Much of the most beautiful mediæval work is found on the vestments and ornaments for the monasteries and churches. Among other famous specimens are two of English origin, the Syon cope of the 13th century, richly charged with scriptural subjects, and the Bayeux Tapestry (q.v.), an example of embroidery with worsteds.

At the present day the Orient stands foremost in art embroidery. The Chinese work is perhaps the most elaborate, done mostly on silk, with brilliant colors; the Japanese embroidery is scarcely less beautiful and elaborate. In Europe and America, there has been in the 19th century a revival of the art of embroidery connected with the increased desire for all forms of decorative art. Practically, embroidery is divided into two distinct classes of work: (1) that which embraces all kinds of artistic needlework done by the hand; and (2) the manufacturing industry which includes all embroidery done by machinery, and hand needlework done on the large scale by following patterns mechanically impressed on the fabric. In art embroidery the materials employed are fine colored worsted yarns called crewels, tapestry wools, embroidery silks, gold and silver threads, span-gles, and plates or disks of metal. The textile basis may be any cloth, but the fabrics principally used are stout makes of linen, silks, satins, velvets, and flannels. Small work is done without any special mounting, but for elaborate designs the fabric is fitted and tightly stretched on a

frame. The number of embroidery stitches is considerable, and they vary with the nature of the design and the materials used. The principal stitches are the cross stitch, the cushion stitch, the crewel stitch, the outline stitch, the herring-bone stitch, the button-hole stitch, the feather stitch, the satin stitch (the best for fine work on silk and satin), and the rope and knot stitches. In frame-work, "couching" is largely employed, which consists in laying lengths of thread on the surface, and securing them by stitches through the cloth brought up at various points. A distinct class of embroidery consists of appliqué or cut work, in which designs of different materials and colors are cut out and sewed down on the surface of the fabric to be ornamented. In its purely mechanical side, the embroidery trade embraces several distinct sections, of which may be enumerated: (1) white embroidery, known also as Swiss or Scotch sewed work; (2) embroidery in gold, silver, and colored silks, for official costumes, civil and military, badges, etc.; and (3) embroidery in crewels, or other colored wools, colored silks, etc., mostly done for furniture decoration, such as borders of table covers. To a great extent these various kinds of embroidery can be worked by one or other of the machines which have been devised for embroidering. The first successful embroidery machine was that invented by M. Josué Heilmann, of Mülhausen, patented in England in 1829. With Heilmann's machine, or the modifications of it which have since been introduced, one person can guide from 80 to 140 needles working simultaneously, and producing so many repeats of the same design. Embroidery patterns, in a variety of knotted, tambour, and other stitches, and ornamental braiding, are now very largely done by means of the Bonnaz machine, the invention of M. Antoine Bonnaz, first patented in England in 1868.

**Bibliography.**—Day and Buckle, 'Art in Needlework' (1900); Higgin, 'Handbook of Embroidery'; Lefèvre, 'Embroidery and Lace' (Eng. trans. 1888); Morris, 'Decorative Needlework'; Palliser (Mrs. Bury), 'Lace and Embroidery.'

**Embrun**, òn-brùn (ancient *Eburodunum Caturigum*), France; town in the department of Hautes-Alpes, on a rocky eminence in the centre of a large plain watered by the Durance, 20 miles east from Gap. It is an ancient place, surrounded by walls and ditches, and of very picturesque appearance. It was pillaged successively by Vandals, Huns, and Saxons, and its inhabitants almost exterminated by the Moors in 966. It is still a bishop's, and was once an archbishop's, see. Pop. 3,812.

**Embryo.** See EMBRYOLOGY.

**Embryology** (ἐμβρυον, a young animal + λόγος, discourse), strictly speaking, is that division of biological science which deals with the structure and growth of the embryo, that is, the young before it is capable of leaving the egg membranes and leading an independent existence. But such limits are inconvenient and the term as usually employed treats of the larval history as well, including all phases of growth until practically the adult form, if not size, is reached.

The account of embryology begins with the egg or ovum. This is a specialized cell (see CELL) formed in the reproductive glands (ovaries) of the mother and differs from all other cells of the body in its capacity, under the proper

conditions, of reproducing an animal like the parent. The eggs of different animals vary greatly in size and appearance. In the simplest condition, as in the starfish and sea-urchin, the egg is a spherical mass of protoplasm (q.v.), with a central specialized portion, the nucleus, all being transparent and having a diameter of about one two hundredths of an inch. From this all variations in size and structure can be traced to the complicated and comparatively enormous eggs of birds. These variations are due to secondary features which are added for the protection and nourishment of the growing embryo.

Thus in the familiar hen's egg there is an external calcareous shell, then the double shell membrane enclosing the albumen or "white." Supported in the white is the yolk, which alone arises in the ovary, the other parts being added by the ducts through which the egg passes on its way to the exterior. Hence the yolk alone is the true egg. This owes its large size (compared with the egg of the starfish) to the fact that it contains not only the protoplasm and nucleus of the latter, but also a large amount of food material (food yolk or deutoplasm). On one side of the yolk is a lighter yellow spot (the "tread"), and in this spot are the nucleus and protoplasm, and in it the processes of development begin. All other parts are secondary or adventitious, and it is to the number, character and amount of these that the differences between the eggs of various animals are due.

In the limits of this article only the simplest and most essential features of development can be described; for details the reader must go to special works, but with greater or less modifications the following account will apply to all eggs.

The egg, as it leaves the ovary, is not ready for development. It must become mature. This process of *maturation* is very complex. In a few words it consists of the formation of two small bodies (*polar globules*), which are thrust out of the egg and play no part in its further history. These polar globules carry with them a small amount of protoplasm and three quarters of the essential material (*chromatin*) of the nucleus. This division of the chromatin is peculiar in that with the formation of the first polar globules half of each kind of chromatin is cast off; with the formation of the second half of the kinds of chromatin are lost. In the formation of the male reproductive element, the *spermatozoon*, there is an essentially similar division of the chromatin. Upon these divisions of the chromatin and the subsequent fertilization of the egg next to be described, all modern theories of heredity are based. After the polar globules are formed the remainder of the original nucleus sink back into the egg and form a *female pronucleus*.

After maturation comes fertilization, which consists in the union of a spermatozoon with the egg. The head of the male element penetrates the protoplasm, increases in size, and forms a *male pronucleus*. The two pronuclei unite and thus there is restored to the egg those chromatin elements which were lost in the formation of the second polar globule. It is to be noticed that in eggs which develop parthenogenetically (that is, without fertilization—see PARTHENOGENESIS) the second polar globule is not formed and hence no lost chromatin has to be restored.

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Excepting parthenogenetic eggs it is only after fertilization that the egg is normally ready to develop and to begin the formation of the embryo. The first step is the division of the single-celled egg into numerous cells, the so-called *segmentation of the egg*. In the simplest eggs these divisions are regular and total, that is, at each division the resulting cells are equal in size and the planes which separate them cut entirely through the egg. With increase in amount of deutoplasm, as in the egg of the frog, there is a difference in the size of the cells, those at one pole being large, those at the other small (*unequal segmentation*). With still further increase in the amount of food yolk, only a part of the egg divides, and we have *partial* or *meroblastic segmentation*, as in the case of sharks, reptiles, and birds. These variations exercise a great influence upon the subsequent history of development, modifying the various processes in ways which are described in embryological text-books. The peculiar *centrolecithal* eggs of crustacea and insects need not be considered here.

In eggs with equal and total segmentation the first division plane cuts the egg into equal halves. The second plane, at right angles to the first, results in quarters. These two planes, from their relation to the meridians of the globe, are termed meridional planes. The third, which is at right angles to the first two, corresponds to the equator and divides the four cells into eight. After this meridional planes and planes parallel to the equator alternate, increasing the cells in geometrical ratio so that we have 2, 4, 8, 16, 32, 64, 128, 256, etc., cells as a result. In unequal segmentation this regularity is soon lost, while in meroblastic eggs the divisions result in a small patch of cells, the *blastoderm*, on one side of the yolk, as in the hen's egg at the time of laying.

At first the cells resulting from this segmentation form a solid mass known as the *morula* (mulberry) stage. Later this becomes a hollow sphere of cells, one layer thick, the so-called *blastula* (Fig. 1 left), its cavity, in contradistinction to other cavities which may appear later in the embryo, being known as the *segmentation cavity* or *blastocæle* (archicæle). In eggs with regular segmentation the wall of the segmentation cavity is composed of equal-sized cells,

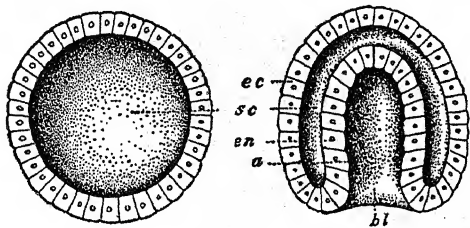


FIG. 1.—Diagrammatic sections of blastula (left) and gastrula (right); *a*, archenteron; *bl*, blastopore; *ec*, ectoderm; *en*, entoderm; *sc*, segmentation cavity.

but in unequally segmenting eggs the cells on one side are thicker than those on the other and the segmentation cavity is more or less excentric in position.

Next in sequence is the differentiation of the single layer of cells of the blastula into the two

primary *germ layers*. The process may be compared to forcing in one side of a hollow rubber ball. One side of the blastula becomes turned into the other, partially or completely obliterating the segmentation cavity. In this way two layers are formed, an outer *ectoderm* (*epiblast* of English embryologists) and an inner *entoderm* (*hypoblast*). The opening into the cavity of the entoderm is known as the *blastopore*, while the cavity itself, from the fact that it forms the digestive tract of the adult, is called the *archenteron*, while for similar reasons the embryo at this stage is termed the *gastrula* (Fig. 1 right). In eggs with unequal segmentation it is the larger cells which form the entoderm, and in this way the food yolk, to which they owe their size, is brought into the walls of the digestive tract. In eggs with meroblastic segmentation the phenomena of formation of the gastrula are greatly modified and are impossible of description in a few words. They can, however, be harmonized with the foregoing account.

The mouth of the gastrula (blastopore) may remain permanently open and form the mouth of the adult, or it may close in the middle, the ends remaining open as mouth and anus. Again only one end may remain open, this forming in some the mouth, in others the anus. Lastly the blastopore may close completely and either mouth or anus may be formed outside its line of closure. From this it is evident that it is important to recognize the limits of the blastopore in tracing resemblances between different groups of animals, and this necessity is increased when we recollect that the central nervous system arises around the blastopore.

In some Coelenterates and scattered members of other groups of animals the two layers, ectoderm and entoderm, may arise in a different way. On arrival at the stage of the blastula the inner ends of the cells which compose its walls become cut off from the outer ends, thus forming the two layers. While in this case the segmentation cavity becomes converted into the archenteron. This process is called *delamination* and is difficult to reconcile with the process described above.

In many Coelenterates and a few other imperfectly known forms, the adult animal does not progress beyond the two-layered stage and hence these are sometimes grouped as the *Diploblastica*, in contrast to the *Triploblastica*, in which a third layer is added. This additional germ layer is the *mesoderm* (mesoblast of the English). It arises either from the entoderm or from the line of junction between ectoderm and entoderm and extends into the space (remains of the segmentation cavity) between these two layers, making up, in most animals, by far the largest part of the adult body. It shows considerable differences in its method of origin even in one and the same animal, and is frequently subdivided by writers into *mesothelium* and *mesenchyme* by characters which need not be detailed here.

From these three (or four) germ layers all the structures of higher animals (metazoa) arise. The derivation of the various structures in man may be enumerated here.

*Ectoderm*.—External layer (epidermis) of skin, hair, nails, sweat and milk glands, brain, spinal cord, nerves, the sensory portions of ears, eyes, nose, etc., lining of mouth, enamel of teeth.



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**Entoderm.**—Lining of digestive tract (including its glands—liver, pancreas, etc.) of Eustachian tube, windpipe, lungs and lining of lungs not of notochord.

**Mesothelium.**—Lining of body cavity (peritoneum), pleura, and pericardium; all voluntary muscles of the body and muscles of the heart; internal reproductive and excretory organs.

**Mesenchyme.**—Deeper layers (derma) of skin, and of alimentary tract; tendons, fat, cartilage, bone, dentine of teeth; involuntary muscles with the exception of those of the heart; blood-vessels, blood, and lymph.

Space will not permit tracing the development of the various organs of all animals from

during this process from a spherical to a more elongate form.

On the dorsal surface, around the line of closure of the blastopore, the ectoderm becomes thickened, forming a *medullary plate*, broader in front. The edges of this plate gradually rise, roll inward toward each other and gradually convert the plate into a tube, from which later will develop the central nervous system. The broader anterior portion gives rise to the brain (Fig. 2), the rest to the spinal cord, while the lumen of the tube forms the canal of the cord as well as the cavities (ventricles) of the brain. Starting from this central system the nerves attain their outward growth later.

The eyes arise in large part from the brain, extending outward from it as hollow vesicles which grow laterally toward the ectoderm of the side of the head. Then the vesicle becomes folded into itself like a double cup, the inner wall of which gradually develops into the retina, while the optic nerve grows backward along the line of the stalk of the cup into the brain. The lens of the eye has its origin in the ectoderm of the side of the head opposite the outgrowing optic vesicle. This thickening increases, becomes folded

into a ball and becomes cut off from the rest to sink to its permanent position at the mouth of the optic cup. The essential or sensory part of the ear begins as a pit on the side of head behind the eye. This deepens and sinks inward to join the outgrowing auditory nerve. It later becomes closed and completely cut off from the skin and by a complicated process of folding becomes developed into the two chambers and the three semicircular canals of the adult, these corresponding in position and origin to those of man. (There are no middle and outer ears in the salamander.)

The entoderm, arising by the modified process of gastrulation, becomes more and more elongate with the lengthening of the embryo. Behind, the canal (archenteron) remains small (Fig. 2, *i*), the ventral wall being enormously thickened by the large amount of yolk present. In front the cavity enlarges to form the liver (*l*), while in front of this is a short portion which has to develop into pharynx, gullet, and stomach. As yet there is no mouth. This arises first as an inpushing of the ectoderm in front (*m*) which later breaks through into the pharynx. In the pharyngeal region paired pockets grow out right and left until they meet the ectoderm with which they fuse (*g*). Then at the bottom of each pocket an opening appears so that this region is in connection with the exterior. These openings are the gill slits. Similar gill pouches are formed in the embryos of all vertebrates, but in the higher groups (reptiles, birds, and mammals) they are transitory with the exception of the anterior which forms the middle ear (tympaenum) and Eustachian tube of the adult. Oesophagus and stomach develop later by elongation and differentiation of the region between the liver and pharynx, while the intestine arises from the part behind the liver outgrowth.

The mesoderm grows in as two double sheets

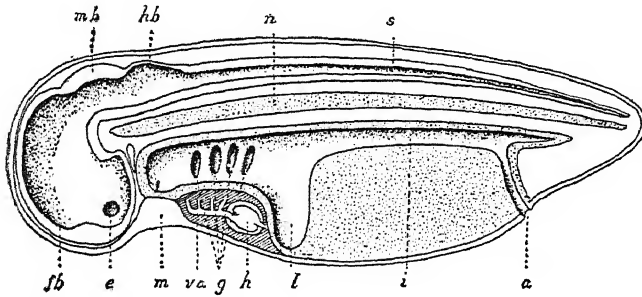


FIG. 2.—Diagrammatic long section of a salamander embryo. *a*, anus; *e*, place of outgrowth of eye; *fb*, fore-brain; *g*, gill slits extending outward from pharynx; *h*, heart in pericardium; *hb*, hind-brain; *l*, intestine; *l*, beginning of liver; *m*, thickening of ectoderm where mouth will form; *mb*, mid-brain; *n*, notochord; *s*, spinal cord; *va*, ventral aorta. Cut surface of entoderm dotted.

these germ layers, but later in this article a slight sketch of the processes as they occur in the vertebrates will be given.

From the stage in which the germ layers are formed some animals develop directly into the adult, while in others larval stages, differing markedly from the adults in appearance, are introduced. In some instances these larvæ are clearly adaptations to enable the young to begin its free life and its self-support as early as possible; in others they are indicative of the ancestry, representing, in the history of the individual, stages passed through in the development of the race. Larvæ are more abundant among marine than among fresh-water or terrestrial forms. See LARVA.

**Development of Organs.**—Space will permit the outlining of the development of organs from the germ layers in but one animal. For reasons of simplicity and of general interest the salamander has been selected as a type of the group of which man is a member.

The eggs of the salamander are laid in the spring, enclosed in a transparent jelly. They are fertilized after being laid, form polar globules, and undergo a total but unequal segmentation, a result of the large amount of food yolk present. The small segmentation cavity is consequently excentric in position. Since the segmentation cavity is small the gastrula cannot be formed in the typical way described above, but rather by a modified type of infolding, not easily described in a few words. The blastopore closes along what will eventually make the middle line of the back, the egg changing



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between the ectoderm and entoderm (Fig. 3, *m*), the space between the two layers being called the coelom (*c*). These mesodermal sheets extend on either side of the body from near the

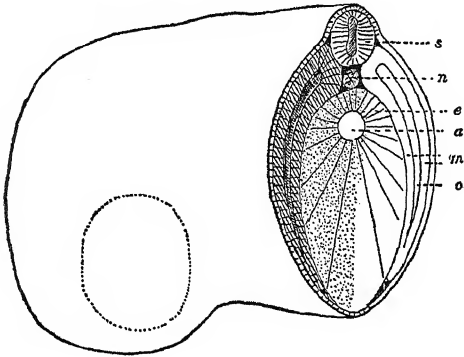


FIG. 3.—Diagram of anterior part of amphibian embryo; *a*, alimentary canal; *c*, coelom or body cavity; *e*, entoderm; *m*, two layers of mesoderm; *n*, notochord; *s*, spinal cord.

tip of the head to the end of the tail. At first they are dorsal in position, but with increase in size the lower margins approach the mid-ventral line, where they finally fuse.

The dorsal portion of each mesoderm plate soon becomes cut up into a series of cubical blocks, the *myotomes*, each myotome containing a portion of the coelom. These myotomes are to furnish the voluntary muscles of the body. They finally separate completely from the rest of the mesoderm and begin to grow downward between the ectoderm and the lower part of the mesoderm until they extend to near the middle ventral line. During this process the inner wall of each myotome becomes transformed into muscle fibres and in this way plates of muscle (familiar to all in the flesh of a fish) arise. The muscles of the limbs arise as buds from a few myotomes in the regions where the limbs are to appear. With the outgrowth of the limb the buds extend into it and gradually become differentiated into the various muscles. The outer layer of the myotome is not transformed into muscle but gives rise to a connective tissue, the *cutis* or *derma*, which, together with the ectoderm (*epidermis*), forms the skin.

From the region just below the myotomes a second series of segments are formed which have for their most marked functions the formation of the excretory organs, and hence are called nephrotomes (*νεφροτὸν*, kidney). The history of these organs is too complex to be followed here. Suffice it to say that in the salamander as in all fish-like vertebrates (Ichthyopsida), there are two kidneys formed in succession, an anterior head-kidney (*pronephros*) and a posterior Wolffian body (*mesonephros*), the latter forming the functional kidney of the adult. In the higher vertebrates (reptiles, birds, and mammals) both pro- and mesonephros are formed in the embryo and these are replaced later by a third kidney (*metanephros*) which alone serves an excretory organ in the adult. The nephrotomes also give rise, directly or indirectly, to the ducts of the reproductive and excretory organs, while from the inner surfaces are budded off cells (mesenchyme)

which, among other functions, have to form the skeleton, mentioned below.

The lower portion of the mesoderm does not become divided as do the two upper regions. Its outer wall becomes applied to the muscles, while its inner covers the various viscera, thus forming the lining or *peritoneum* of the lower part of the coelom which is usually called the body cavity. The only division of this cavity in the lower vertebrates is by means of a transverse partition, the *septum transversum*, which separates an anterior *pericardium* containing the heart from the peritoneal cavity containing the other viscera. In the mammals a second partition, the *diaphragm*, occurs behind the first, marking off the pleural cavities, containing the lungs, from the rest of the peritoneal cavity.

The first skeletal structure to appear is the notochord, a rod of gelatinous tissue which arises in the middle dorsal line from the entoderm, becomes cut off from it and comes to lie between the digestive tract and the central nervous system (Figs. 2, 3 *n*). Behind, it extends to the tip of the tail, but in front it does not reach the tip of the head, but is terminated at a down-growth from the brain, the infundibulum. This rod is not jointed, but serves as a centre around which the vertebrae and the base of the posterior part of the skull arise.

The tissue for the vertebrae and the floor of the skull is furnished by the mesenchyme from the nephrotomes, the origin of which was alluded to above. This tissue gathers around the notochord and forms rings around it, the bodies of the vertebrae; while connected with each body is a plate on either side, the two plates meeting above the spinal cord and forming the *neural arch*. Extending outward between the muscle plates are the rudiments of the ribs. At first vertebrae and ribs are cartilaginous, but later the cartilage becomes replaced by bone. In the head region a cartilaginous skull arises in a somewhat similar way. This is very complex, but may be divided into a cranial and a visceral portion, the latter consisting of cartilage bars for the jaws and between the gill slits. In the cranium only that part which arises around the anterior extremity of the notochord can be compared to the vertebrae. This cartilaginous skull becomes converted into the bony skull of the adult, in part by direct conversion of the cartilages into bone, in part by the formation of additional bones (dermal bones) in the skin which unite with those of cartilaginous origin. The skeletons of the girdles and limbs are almost entirely of cartilage origin, only the coracoid arising as a dermal bone.

The circulatory system is very complicated and only a small part of its development can be outlined here. In the pharyngeal region the descending plates of mesoderm meet below the entoderm, enclosing between them a tube lined by cells of uncertain, though probably of entodermal origin. These cells form the lining of the heart (*endothelium*), while the walls of mesoderm later furnish the muscles of this organ. The coelom of this region becomes converted into the pericardial cavity.

At first this heart tube is straight, but since it grows faster than the pericardium it becomes twisted somewhat like the letter S and the auricle and ventricle develop out of the folds of the twist (Fig. 2, *h*), valves soon appearing

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between these chambers. Behind the heart the edges of the mesoderm are prevented from joining by the presence of the liver and hence there arise here two vessels which bring the blood from behind to the heart. In front of the heart is formed in a similar way a tube, the ventral aorta (Fig. 2 *va*), from which vessels (*aortic arches*) gradually grow upward around the pharynx in the tissue between the gill slits. These finally enter vessels above the pharynx which by their union form the dorsal aorta which runs backward above the alimentary tract to the tail. From this dorsal aorta vessels are given off at regular intervals which extend out laterally between the myotomes and serve to carry blood to these last.

From this comparatively simple arrangement the more complicated blood system of the adult is developed by the appearance of other vessels and the disappearance of some which are formed at first; the details of which must be sought in special works. One or two points have more interest and may be mentioned here. For various reasons it seems certain that in the early vertebrates there were formed six pairs of these aortic arches connecting the ventral and dorsal aortæ. In the salamander only the posterior four of these come to development, the anterior two on either side remaining rudimentary. In the development of the higher animals, as in man, there is the same formation of paired arches in the early embryo. Later in the history the fifth arch on either side is entirely lost, the sixth loses its connection with the dorsal aorta and sends its blood to the lungs, thus giving rise to the pulmonary arteries. Of the third pair that on the right side largely disappears, while that on the right persists as the "arch of the aorta" of human anatomy and alone carries blood to the dorsal aorta and the trunk. The anterior arches also lose their connection with the posterior dorsal trunks and give rise to the carotid arteries which carry blood to the head.

With this outline of the comparatively simple development of the salamander the more complicated features of the history of a higher vertebrate can better be understood. In many of their features these closely parallel the account just given. In the reptiles, birds, and mammals other features are added. Thus at an early stage there is formed an embryonic envelope which encloses the whole germ. In some mammals as in man this arises by a splitting of the ectoderm so that the embryo comes to lie in a cavity roofed in above by a delicate membrane, the *amnion*. In many other mammals, as in reptiles and birds, this amnion arises by an up-growth of ectoderm all around the embryo, these growths finally meeting and fusing above the embryo, thus finally enclosing an amniotic cavity similar to that in man.

In the salamander egg, the amount of food yolk is comparatively small. In the birds and reptiles it is enormous in amount. As a result the young reptile or bird appears as a small outgrowth on the surface of a large sphere of yolk. The presence of this causes the blood vessels described above as entering the heart from behind to extend down over the yolk, while other vessels extend to the same region from the dorsal aorta. By means of these a yolk circulation is set up and thus the yolk itself is gradually torn down and carried by the vessels

into the circulation and thus used in building up the body. Later this yolk circulation, lying beneath the egg shell, serves as a means of respiration, absorbing oxygen from the air and giving off the carbon dioxide produced by growth.

In most mammals the whole embryonic period (including the foetal stages) is passed inside the mother, a fact which has resulted in considerable modifications of the processes. Thus the egg has lost its food yolk and has a total, although irregular, segmentation. Larval organs have been lost, but the most remarkable changes are the provisions for furnishing nourishment to the growing embryo and the later foetus. These may be briefly summarized by saying that an outgrowth occurs at the hinder end of the alimentary canal, the *allantois*, which carries with it arteries and a vein. This allantois increases in size, extending outward into the amniotic cavity, and finally uniting with its outer wall, the chorion. From this union is developed that structure so characteristic of mammals, the *placenta*. This portion comes in contact with the walls of the maternal uterus, while from its outer surface are developed numerous small, thread-like outgrowths, the chorionic villi. These penetrate into the uterine walls, which in the meantime have become spongy through the great development of blood vessels, and from this union the placenta is formed. Blood (or rather its serum) passes by osmosis from the vessels of the uterus into the villi and thence by the allantoic vein to the embryo, while blood which has done its work in the embryo is carried back by the same course to the mother. It is to be noted that at no time is there a direct connection of the blood vessels of parent and off-spring, all transfer being osmotic.

With growth the placenta increases in size, while the stalk of the allantois and accessory structures remain small, and these smaller portions form the umbilical cord. The placenta varies in different animals, three chief types being recognized. In the cotyledonary, as in domestic cattle, the villi are gathered in numerous small patches or cotyledons; in the zonary type, as in dogs, the villi form a girdle or zone around the foetal envelopes; while in the discoidal condition (man), the villi occupy a disk-like area on the envelopes. At birth the young mammal is in position to breathe for itself and to take food into the alimentary canal and hence the placental structures are no longer of value. They are, therefore, cast out as the "afterbirth," carrying with them a part of the uterine lining.

The literature of embryology is very large and reference can be made to but a few manuals, which, however, have good bibliographies. A classic work is Balfour's 'Treatise on Embryology' (2 vols., London 1880-1), which includes all groups of animals. Most recent for invertebrates is the *Embryology of Korschelt and Heider* (translated in 4 volumes, 1900). For vertebrates the best text-books are Minot, 'Human Embryology' (1892), and Mark's translation of Hertwig's 'Embryology' (1892). A smaller, more recent and very clear work is McMurrich, 'Development of the Human Body' (1902). All of these, while emphasizing man in the titles, deal with other vertebrates.

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**Embury, Emma Catharine Manley**, American writer: b. New York 1806; d. Brooklyn, N. Y., 10 Feb. 1863. She was married to Daniel Embury in 1828. Much of her work for periodicals was over the pen-name "Ianthé." Among her published works are: 'Guido and Other Poems' (1828); 'Female Education'; 'The Blind Girl, and Tales'; 'Love's Token Flowers' (1846); 'Poems' (1869).

**Embury, Philip**, Methodist clergyman: b. Ballygaran, Ireland, 21 Sept. 1729; d. Camden, N. Y., August 1775. He joined John Wesley's society and became a local preacher at Court-Matress in 1758. Emigrating to New York in 1760, he began to preach in his own house in 1766, and two years later erected a chapel on the site of the present "Old John Street Church." Being a carpenter by trade, he worked on the building with his own hands and completed the pulpit, in which he preached the sermon of dedication 30 Oct. 1768. This was the first Methodist chapel of the New World, and he has been called "the founder of American Methodism." It was, however, at Camden, Washington County, N. Y., that he did his greatest work, forming there a congregation which grew into the flourishing and influential Troy Conference.

**Em'den**, Germany, town, in the province of Hanover, on the Ems, near where it discharges itself into the Dollart estuary. Emden has an excellent roadstead, and its harbor is connected with this by a canal admitting large vessels. The Dortmund-Ems and other canals connect it with the interior. Its export trade includes grain, dairy produce, cattle, tallow, wool, hides, etc.; and it imports coal, timber, wine, and colonial produce. A considerable number of vessels are built here annually; and the manufactures include leather, paper, wire ropes, bricks, soap, and tobacco. There are also oil-mills, breweries, and distilleries. Pop. (1900) 16,453.

**Emelé, ā-mā-lā, Wilhelm**, German painter: b. Buchen, Odenwald, 1830. He first adopted a military career but studied art with Dietz at Munich, and later at Antwerp and Paris. His canvases are noted for exactness of details, his subjects being military. He has lived in Vienna since 1861. Among his works are: 'Battle of Stockach'; 'Capture of Heidelberg Bridge in 1799' (1857); 'The Fight Near Aldenhoven' (1859); 'The Square of the Battle of Aspern' (1860); 'Capture of Camp Near Farmers'; 'Attack on the English by French Cuirassiers at Waterloo'; 'Battle of Wurzburg' (1867), his best work; 'The Archduke Charles at Battle of Neerwinden' (1872); 'Attack of the Bournern Division Near Elsasshausen'; 'Battle of Dijon'; 'Meeting of Patrols of Seventh and Fourteenth Corps, Prussian Army, Near Vesoul'; 'Headquarters of 14th Army Corps in Battle of Belfast'; 'Episode of Battle of Worth'; 'Victory of George II. over the French at Dettingen' (1879).

**Emerald** (O. Fr. *emeraude*, Gr. *σμάραγδος*), a gem of pure green color, often very rich and beautiful. It is a variety of the mineral beryl and is, therefore, a silicate of aluminum and glucinum (q.v.), its green color being due to the presence of a little chromium. It is usually found in nodules or in distinct six-sided prisms of the hexagonal system. It is a little harder than quartz, and has a specific gravity of about

2.69. It is not acted on by acids. Many of the most intensely colored and valuable emeralds that we are acquainted with were brought from Peru, the largest from Takowaja, in the Urals, a specimen of which is seen in the 634-pound stone at St. Petersburg. Most modern emeralds come from the Republic of Colombia, which quite supplies the current market. In the United States emerald crystals up to nine inches in length and of rich color have been found in Alexander County, N. C., while extensive mining in Mitchell County, N. C., has yielded beautiful gems and much so-called "emerald matrix." The rarity, rich color, brilliancy and hardness of emerald have made it one of the most highly prized of gems. "Oriental emerald" is green sapphire (q.v.), "lithia emerald" is hiddenite (q.v.), "Uralian emerald" is demantoid (q.v.), "Brazilian emerald" is tourmaline (q.v.). See also BERYL and GEMS.

**Emerald Green**, known also as **Schweinfurth** or **Paris Green**, and by a great number of other names, is one of the most beautiful green pigments. It appears to contain copper, arsenic, and acetic acid, and is usually regarded as an aceto-arsenite of copper. It is a crystalline powder, which becomes paler by grinding, is not affected by light and air, and is insoluble in water, but is decomposed by alkalis. It is used both as a water and as an oil color, and is used for tinting wall-papers, though with much less frequency since the danger of that practice has been discovered.

**Emerald Isle**, an epithet applied to Ireland, from the freshness and bright color of the verdure, produced by the abundant heat and moisture continually reaching it from the Atlantic. This epithet was first used by Dr. W. Drennan (1754-1820), in his poem entitled 'Erin.'

**Emerald Wedding**. See WEDDING ANNIVERSARIES.

**Emerson, Charles Wesley**, American educator: b. Pittsfield, Vt., 30 Nov. 1837. Studying law, medicine and theology, he was a clergyman for many years. He founded the Emerson College of Oratory, Boston (1880), and has since been its president, teaching oratory, physical culture and voice development.

**Emerson, Edward Waldo**, American physician and author: b. Massachusetts 1844. He is a son of Ralph Waldo Emerson (q.v.). He was graduated at Harvard College and Harvard Medical School, and is an instructor in anatomy at the Boston Museum of Fine Arts. He has published: 'Emerson in Concord' (1888); and an edition of the 'Correspondence of John Sterling and Ralph Waldo Emerson, with sketch of Sterling's Life.'

**Emerson, Mrs. Ellen (RUSSELL)**, American author: b. New Sharon, Maine, 16 Jan. 1837. She was married to Edwin Emerson (1862). Her works are: 'Indian Myths' (1884); 'Masks, Heads, and Faces, with Considerations Respecting the Rise and Development of Art' (1891).

**Emerson, George Barrell**, American educator: b. Kennebunk, York County, Maine, 12 Sept. 1797; d. Newton, Mass., 14 March 1881. He was graduated at Harvard College (1817), and was the tutor in mathematics and natural philosophy there (1819-21). In 1823 he opened

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a private school for girls in Boston, which he conducted until 1855, when he retired from professional life. He wrote the second part of the 'School and Schoolmaster,' of which the first part was written by Bishop Potter of Pennsylvania. He was appointed chairman of the commissioners for the zoological and botanical survey of Massachusetts, in which capacity he published a 'Report of the Trees and Shrubs Growing Naturally in the Forests of Massachusetts' (1846).

**Emerson, Luther Orlando**, American composer: b. Parsonsfield, Maine, 3 Aug. 1820. He studied music and later taught for eight years in Salem, Mass. He then served as organist and musical director in various churches in Massachusetts, and was the director of about 300 musical festivals and conventions. He has published: 'The Romberg Collection' (1853); 'The Golden Wreath' (1857); 'The Golden Harp' (1858); 'The Sabbath Harmony' (1860); 'The Heart of Judah' (1863); 'Jubilate' (1866); etc.

**Emerson, Oliver Farrar**, American educator: b. Traer, Iowa, 1860. He studied at Iowa College, taking a post-graduate course at Cornell University. After serving as superintendent and principal of schools in Grinnell and Muscatine, Iowa, he was principal of the Academy of Iowa College (1885-8); instructor in English (1889-91) Cornell University, and assistant professor of rhetoric and English philology in the same institution (1892-6), when he took the same chair in Western Reserve University. He is secretary of the American Dialect Society, and is a regular contributor to philological papers. He has published: 'History of the English Language' (1894); 'A Brief History of the English Language' (1896); an edition of 'Dr. Johnson's Rasselas' (1895); and 'Memoirs of the Life and Writings of Edward Gibbon' (1898).

**Emerson, Ralph Waldo**, American poet and philosopher: b. Boston 25 May 1803; d. Concord, Mass., 27 April 1882. He was the son of a Unitarian clergyman. He was graduated at Harvard in 1821, and for five years taught in a school. Having studied divinity he was ordained colleague of Rev. Henry Ware at the Second Unitarian Church in Boston in 1829, but in 1832 resigned his charge, announcing his unwillingness any longer to administer the rite of the Lord's Supper. In Dec. 1832 he sailed for Europe and remained there nearly a year, having had interviews with Carlyle, Coleridge, Wordsworth, and other eminent writers. On his return he began his career as a lecturer, in which capacity he acted for a long series of years, and became known throughout the whole of the United States. In 1835 he took up his permanent residence at Concord, Mass. In 1836 he published a small volume called 'Nature,' treating of freedom, beauty, and culture in relation to the outer world. He was one of the original editors and chief supporters of 'The Dial,' a magazine begun in 1840, and identified with the trend of thought known as "transcendentalism." Two volumes of his 'Essays' were published in 1841 and 1844, and his 'Poems' in 1846. His 'Miscellaneous Addresses' had been collected and published in England in 1844, and on visiting there in 1847 he was welcomed by a large circle of admirers. In 1850 he published 'Representative Men,' including portraits

of Plato, Shakespeare, Montaigne, Swedenborg, Napoleon, Goethe; in 1856, 'English Traits'; in 1860, 'The Conduct of Life'; in 1869, 'May Day and Other Poems,' and 'Society and Solitude'; in 1871, 'Parnassus,' a compilation of poems; in 1876, 'Letters and Social Aims'; in 1893, 'Natural History of Intellect and Other Papers' appeared. He was twice married. He took but little active part in public life, but was always ready to lend his voice on behalf of any important movement. Though sometimes looked upon as a philosopher he was more of a poet and literary man than a systematic teacher, his writings being rather more suggestive of thought than directly didactic. Some of his essays, it has been remarked, seem "merely accidental collections of loose leaves from a note-book." Consult: Cooke, G. W., 'Ralph Waldo Emerson: Life, Writings, and Philosophy' (1882); Conway, 'Emerson at Home and Abroad' (1882); Ireland, 'Ralph Waldo Emerson: a Biographical Sketch' (1882); Holmes, O. W., 'Ralph Waldo Emerson' (1885); Cabot, 'A Memoir of Ralph Waldo Emerson' (1887); Emerson, E. W., 'Emerson in Concord' (1889); Benton, 'Emerson as a Poet' (1889); Chapman, J. J., 'Emerson and Other Essays' (1898); Woodberry, 'Life of Emerson'; Sanborn, 'Emerson.'

**Emerson as Seer.\*** Emerson was not a logician or reasoner, and not a rhetorician, in the common sense. He was a poet, who wrote chiefly in prose, but also in verse. His verse was usually rough, but sometimes finished and melodious; it was always extraordinarily concise and expressive. During his engagement to the lady who became his second wife, he wrote thus to her: "I am born a poet—of a low class, without doubt, yet a poet; that is my nature and vocation. My singing, be sure, is very husky, and is, for the most part, in prose. Still, I am a poet in the sense of a perceiver and dear lover of the harmonies that are in the soul and in matter, and specially of the correspondences between these and those." This husky poet had his living to get. His occupations in life were those of the teacher, minister, lecturer, and author. He was a teacher at various times between 1818 and 1826, but he never liked teaching; a preacher at intervals from 1826 to 1847; but a settled minister only from 1829 to 1832. His career as a lecturer began in the autumn of 1833, and his first book, 'Nature,' was published in 1836, when he was 33 years old. His lectures for money were given as a rule during the winter and early spring, and for 30 years the traveling he was obliged to do in search of audiences was often extremely fatiguing and not without serious hardships and exposures. These occupations usually gave him an income sufficient for his simple wants; but there were times when outgo exceeded income. The little property his first wife left him (\$1,200 a year) relieved him from serious pecuniary anxiety by 1834, although it did not relieve him from earning by his own labor the livelihood of his family. In 1834 he went to live in Concord where his grandfather had been the minister at the time of the Revolution, and in 1835 he bought the house and grounds there which were his home for the rest of his days. Before settling in Concord, he had

\*Address at Symphony Hall, Boston, 24 May 1903. Courtesy of Houghton, Mifflin & Company.

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RALPH WALDO EMERSON.

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spent one winter and spring (1826-7) in the Southern States, and seven months of 1833 in Europe. Both of these absences were necessitated by the state of his health, which was precarious during his young manhood. With these exceptions, he had lived in Boston or its immediate neighborhood, until he settled in Concord. His progenitors on both sides were chiefly New England ministers. His formal education was received in the Boston Latin School and Harvard College, and was therefore purely local. How narrow and provincial seems his experience of life! A little city, an isolated society, a country village! Yet through books, and through intercourse with intelligent persons, he was really "set in a large place." The proof of this largeness, and of the keenness of his mental and moral vision, is that, in regard to some of the chief concerns of mankind, he was a seer and a fore-seer. This prophetic quality of his I hope to demonstrate in three great fields of thought—education, social organization, and religion.

Although a prophet and inspirer of reform, Emerson was not a reformer. He was but a halting supporter of the reforms of his day; and the eager experimenters and combatants in actual reforms found him a disappointing sort of sympathizer. His visions were far-reaching, his doctrines often radical, and his exhortations fervid; but when it came to action, particularly to habitual action, he was surprisingly conservative. With an exquisite candor and a gentle resolution of rarest quality he broke his strong ties to the Second Church of Boston before he was 30 years old, abandoning the profession for which he had been trained, and which, in many of its aspects, he honored and enjoyed; yet he attended church on Sundays all his life with uncommon regularity. He refused to conduct public prayer, and had many things to say against it; but when he was an overseer of Harvard College, he twice voted to maintain the traditional policy of compelling all the students to attend morning prayers, in spite of the fact that a large majority of the faculty urgently advocated abandoning that policy. He manifested a good deal of theoretical sympathy with the community experiments at Brook Farm and Fruitlands; but he declined to take part in them himself. He was intimate with many of the leading abolitionists, but no one has described more vividly their grave intellectual and social defects. He laid down principles which, when applied, would inevitably lead to progress and reform; but he took little part in the imperfect step-by-step process of actual reforming. He probably would have been an ineffective worker in any field of reform; and, at any rate, strenuous labor on applications of his philosophy would have prevented him from maintaining the flow of his philosophic and prophetic visions. The work of giving practical effect to his thought was left for other men to do—indeed for generations of other serviceable men, who, filled with his ideals, will slowly work them out into institutions, customs, and other practical values.

When we think of Emerson as a prophet, we at once become interested in the dates at which he uttered certain doctrines, or wrote certain pregnant sentences; but just here the inquirer meets a serious difficulty. He can sometimes ascertain that a given doctrine or sentence was published at a given date; but he may be quite

unable to ascertain how much earlier the doctrine was really formulated, or the sentence written. Emerson has been dead 21 years; and it is 30 years since he wrote anything new; but his whole philosophy of life was developed by the time he was 40 years old, and it may be doubted if he wrote anything after 1843, the germinal expression of which may not be found in his journals, sermons, or lectures written before that date. If, therefore, we find in the accepted thought or established institutions of to-day recent developments of principles and maxims laid down by Emerson, we may fairly say that his thought outran his times certainly by one, and probably by two generations of men.

I take up now the prophetic teachings of Emerson with regard to education. In the first place, he saw, with a clearness to which very few people have yet attained, the fundamental necessity of the school as the best civilizing agency, after steady labor, and the only sure means of permanent and progressive reform. He says outright: "We shall one day learn to supersede politics by education. What we call our root-and-branch reforms, of slavery, war, gambling, intemperance, is only medicating the symptoms. We must begin higher up—namely, in education." He taught that if we hope to reform mankind, we must begin not with adults, but with children: we must begin at school. There are some signs that this doctrine has now at last entered the minds of the so-called practical men. The Cubans are to be raised in the scale of civilization and public happiness; so both they and we think they must have more and better schools. The Filipinos, too, are to be developed after the American fashion; so we send them a thousand teachers of English. The Southern States are to be rescued from the persistent poison of slavery; and, after 40 years of failure with political methods, we at last accept Emerson's doctrine, and say: "We must begin earlier—at school." The city slums are to be redeemed; and the scientific charity workers find the best way is to get the children into kindergartens and manual training schools.

Since the Civil War, a whole generation of educational administrators has been steadily at work developing what is called the elective system in the institutions of education which deal with the ages above 12. It has been a slow, step-by-step process, carried on against much active opposition and more sluggish obstruction. The system is a method of educational organization which recognizes the immense expansion of knowledge during the 19th century, and takes account of the needs and capacities of the individual child and youth. Now, Emerson laid down in plain terms the fundamental doctrines on which this elective system rests. He taught that the one prudence in life is concentration; the one evil, dissipation. He said: "You must elect your work: you shall take what your brain can, and drop all the rest." To this exhortation he added the educational reason for it—only by concentration can the youth arrive at the stage of doing something with his knowledge, or get beyond the stage of absorbing and arrive at the capacity for producing. As Emerson puts it, "Only so can that amount of vital force accumulate which can make the step from knowing to doing." The educational institutions of to-day have not yet fully appreciated this all-important step from

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knowing to doing. They are only beginning to perceive that, all along the course of education, the child and the youth should be doing something as well as learning something; should be stimulated and trained by achievement; should be constantly encouraged to take the step beyond seeing and memorizing to doing—the step, as Emerson says, “out of a chalk circle of imbecility into fruitfulness.” Emerson carried this doctrine right on into mature life. He taught that nature arms each man with some faculty, large or small, which enables him to do easily some feat impossible to any other, and thus makes him necessary to society; and that this faculty should determine the man's career. The advocates of the elective system have insisted that its results were advantageous for society as a whole, as well as for the individual. Emerson put this argument in a nutshell, at least 50 years ago: “Society can never prosper, but must always be bankrupt, until every man does that which he was created to do.”

Education used to be given almost exclusively through books. In recent years there has come in another sort of education through tools, machines, gardens, drawings, casts, and pictures. Manual training, shop-work, sloyd, and gardening have come into use for the school ages; the teaching of trades has been admitted to some public school systems; and, in general, the use of the hands and eyes in productive labor has been recognized as having good educational effects. The education of men by manual labor was a favorite doctrine with Emerson. He had fully developed it as early as 1837, and he frequently recurred to it afterward. In December of that year in a course of lectures on ‘Human Culture,’ he devoted one lecture to ‘The Hands.’ He saw clearly that manual labor might be made to develop not only good mental qualities, but good moral qualities. To-day, it is frequently necessary for practical teachers, who are urging measures of improvement, to point this out, and to say, just as Emerson said two generations ago, that any falseness in mechanical work immediately appears; that a teacher can judge of the moral quality of each boy in the class before him better and sooner from manual work than from book-work. Emerson taught that manual labor is the study of the external world; that the use of manual labor never grows obsolete, and is inapplicable to no person. He said explicitly, “A man should have a farm or a mechanical craft for his culture”; that there is not only health, but education in garden work; that when a man gets sugar, hominy, cotton, buckets, crockery ware, and letter paper by simply signing his name to a check, it is the producers and carriers of these articles that have got the education they yield, he only the commodity; and that labor is God's education. This was Emerson's doctrine more than 60 years ago. It is only 10 years since the Mechanic Arts High School was opened in Boston.

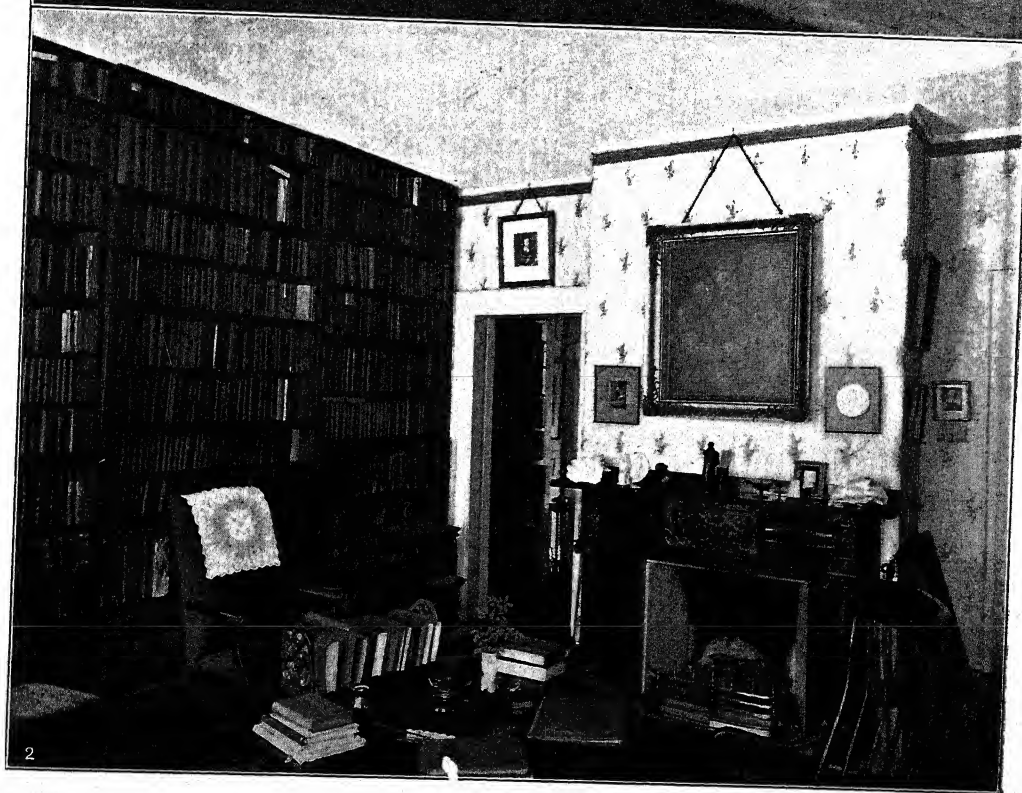
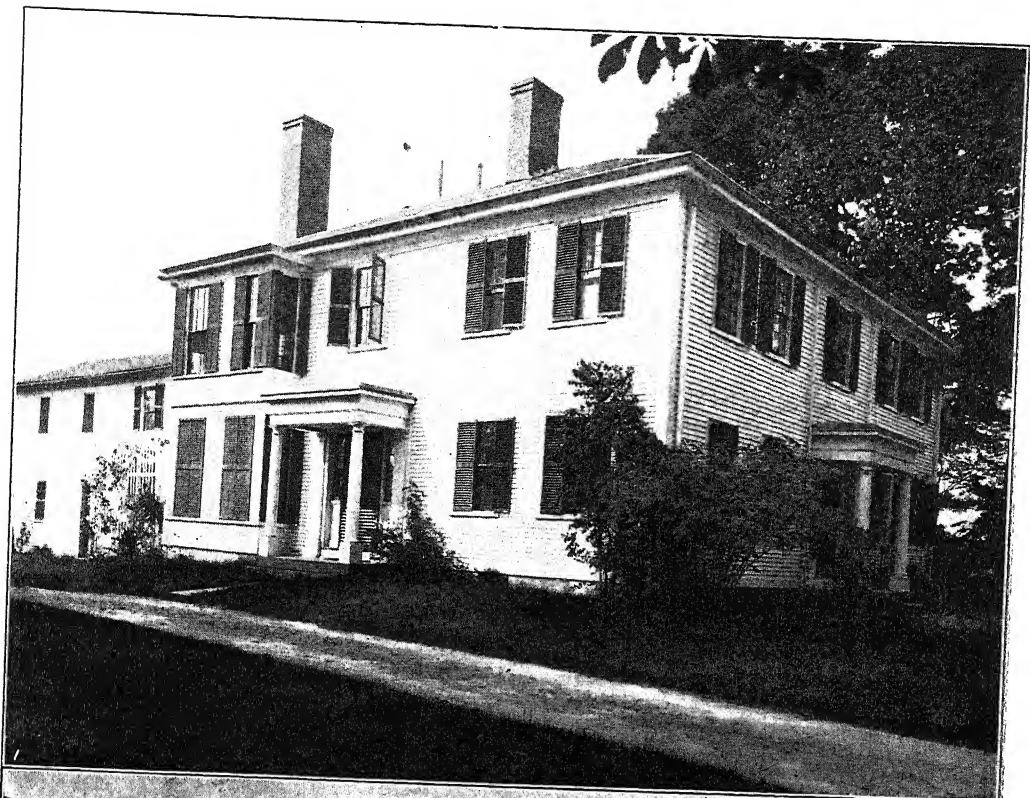
We are all of us aware that within the last 20 years there has been a determined movement of the American people toward the cultivation of art, toward the public provision of objects which open the sense of beauty and increase public enjoyment. It is curious to see how literally Emerson prophesied the actual direction of these efforts:

On the city's paved street  
Plant gardens lined with lilac sweet;

Let spouting fountains cool the air,  
Singing in the sun-baked square;  
Let statue, picture, park, and hall,  
Ballad, flag, and festival  
The past restore, the day adorn,  
And make to-morrow a new morn!

We have introduced into our schools, of late years, lessons in drawing, modeling, and designing,—not sufficiently, but in a promising and hopeful way. Emerson taught that it is the office of art to educate the perception of beauty; and he precisely describes one of the most recent of the new tendencies in American education and social life, when he says: “Beauty must come back to the useful arts, and the distinction between the fine and the useful arts be forgotten.” That sentence is the inspiration of one of the most recent of the efforts to improve the arts and crafts, and to restore to society the artistic craftsman. But how slow the institutional realization of this ideal of art education! We are still struggling in our elementary and secondary schools to get a reasonable amount of instruction in drawing and music, and to transfer from other subjects a fair allotment of time to these invaluable elements of true culture. They speak the universal language. Yet the ultimate object of art in education is to teach men to see nature to be beautiful and at the same time useful; beautiful, because alive and reproductive; useful, while symmetrical and fair. Take up to-day the last essays on education, the last book on landscape architecture, or the freshest teachings of the principles of design, and you will find them penetrated with Emerson's doctrine of art as teacher of mankind. Emerson insists again and again that true culture must open the sense of beauty; that “a man is a beggar who only lives to the useful.” It will probably require several generations yet to induce the American people to accept his doctrine that all moments and objects can be embellished, and that repose in energy, cheerfulness, and serenity are the “end of culture and success enough.”

It has been clearly perceived of late that a leading object in education is the cultivation of fine manners. On this point the teachings of Emerson are fundamental; but the American institutions of education are only beginning to appreciate their significance. He teaches that genius or love invents fine manners, “which the baron and the baroness copy very fast, and by the advantage of a palace, better the instruction. They stereotype the lesson they have learned into a mode.” There is much in that phrase, “by the advantage of a palace.” For generations, American institutions of education were content with the humblest sort of shelters, with plain wooden huts and brick barracks, and unkempt grounds about the buildings. They are only lately beginning to acquire fine buildings with pleasing surroundings; that is, they are just beginning to carry into practice Emerson's wisdom of 60 years ago. The American cities are beginning to build handsome houses for their high schools. Columbia University builds a noble temple for its library. The graduates and friends of Harvard like to provide her with a handsome fence round the yard, with a fair array of shrubs within the fence, with a handsome stadium instead of shabby, wooden seats round the football gridiron, and to take steps for securing in the future broad connections between the grounds of the university and the Cambridge parks by the river. They are just now carrying



1. Home of Emerson at Concord, Mass.

2. Library in the Emerson Home.



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into practice Emerson's teaching; by the advantage of a palace they mean to better Harvard's instruction in manners. They are accepting his doctrine that "manners make the fortune of the ambitious youth; that for the most part his manners marry him, and, for the most part, he marries manners. When we think what keys they are, and to what secrets; what high lessons, and inspiring tokens of character they convey, and what divination is required in us for the reading of this fine telegraph,—we see what range the subject has, and what relations to convenience, power, and beauty."

In Emerson's early days there was nothing in our schools and colleges which at all corresponded to what we now know too much about under the name of athletic sports. The elaborate organization of these sports is a development of the last 30 years in our schools and colleges; but I find in Emerson the true reason for the athletic cult, given a generation before it existed among us. Your boy "hates the grammar and Gradus, and loves guns, fishing-rods, horses, and boats. Well, the boy is right, and you are not fit to direct his bringing-up, if your theory leaves out his gymnastic training. . . . Football, cricket, archery, swimming, skating, climbing, fencing, riding are lessons in the art of power, which it is his main business to learn. . . . Besides, the gun, fishing-rod, boat, and horse constitute, among all who use them, secret free-masonries." We shall never find a completer justification of athletic sports than that.

In his memorable address on 'The American Scholar,' which was given at Cambridge in 1837, Emerson pointed out that the function of the scholar should include creative action, or, as we call it in these days, research, or the search for new truth. He says: "The soul active . . . utters truth, or creates. . . . In its essence it is progressive. The book, the college, the school of art, the institution of any kind, stop with some past utterance of genius. . . . They look backward and not forward. But genius looks forward. Man hopes: genius creates. Whatever talents may be, if the man create not, the pure efflux of the Deity is not his;—cinders and smoke there may be, but not yet flame." And more explicitly still, he says: "Colleges have their indispensable office—to teach elements. But they can only highly serve us when they aim not to drill, but to create." When Emerson wrote this passage, the spirit of research, or discovery, or creation had not yet breathed life into the higher institutions of learning in our country; and to-day they have much to do and to acquire before they will conform to Emerson's ideal.

There are innumerable details in which Emerson anticipated the educational experiences of later generations. I can cite but two of them. He taught that each age must write its own books; "or rather, each generation for the next succeeding. The books of an older period will not fit this." How true that is in our own day, when 80,000 new books come from the press of the civilized world in a single year! Witness the incessant re-making or re-casting of the books of the preceding generation! Emerson himself has gone into thousands of books in which his name is never mentioned. Even history has to be re-written every few years, the long-surviving histories being rather monuments

of style and method than accepted treasuries of facts. Again, contrary to the prevailing impression that the press has, in large measure, stripped eloquence of its former influence, Emerson taught that "if there ever was a country where eloquence was a power, it is the United States." He included under eloquence the useful speech, all sorts of political persuasion in the great arena of the Republic, and the lessons of science, art, and religion which should be "brought home to the instant practice of thirty millions of people," now become eighty. The colleges and universities have now answered in the affirmative Emerson's question, "Is it not worth the ambition of every generous youth to train and arm his mind with all the resources of knowledge, of method, of grace, and of character to serve such a constituency?" But then Emerson's definition of eloquence is simple, and foretells the practice of to-day rather than describes the practice of Webster, Everett, Choate, and Winthrop, his contemporaries: "Know your fact; hug your fact. For the essential thing is heat, and heat comes of sincerity. . . . Eloquence is the power to translate a truth into language perfectly intelligible to the person to whom you speak."

I turn next to some examples of Emerson's anticipation of social conditions, visible to him as seer in his own day, and since become plain to the sight of the ordinary millions. When he accumulated in his journals the original materials of his essay on Worship, there were no large cities in the United States in the present sense of that term. The great experiment of democracy was not far advanced, and had not developed many of its sins and dangers; yet how justly he presented them in the following description: "In our large cities, the population is godless, materialized—no bond, no fellow-feeling, no enthusiasm. These are not men, but hungers, thirsts, fevers, and appetites walking. How is it people manage to live on, so aimless as they are? . . . There is faith in chemistry, in meat and wine, in wealth, in machinery, in the steam-engine, galvanic battery, turbine wheels, sewing-machines, and in public opinion, but not in divine causes."

In Emerson's day, luxury in the present sense had hardly been developed in our country; but he foresaw its coming, and its insidious destructiveness. "We spend our incomes for paint and paper, for a hundred trifles, I know not what, and not for the things of a man. Our expense is almost all for conformity. It is for cake that we run in debt; it is not the intellect, not the heart, not beauty, not worship, that costs us so much. Why needs any man be rich? Why must he have horses, fine garments, handsome apartments, access to public houses and places of amusement? Only for want of thought. . . . We are first thoughtless, and then find that we are moneyless. We are first sensual and then must be rich." He foresaw the young man's state of mind to-day about marriage—I must have money before I can marry; and deals with it thus: "Give us wealth and the home shall exist. But that is a very imperfect and inglorious solution of the problem, and therefore no solution. Give us wealth! You ask too much. Few have wealth; but all must have a home. Men are not born rich; in getting wealth the man is generally sacrificed, and often is sacrificed without acquiring wealth at last."

## EMERSON

We have come to understand by experience that the opinion of masses of men is a formidable power which can be made safe and useful. In earlier days this massed opinion was either despised or dreaded; and it is dreadful if either confined or misdirected. Emerson compares it to steam. Studied, economized, and directed, steam has become the power by which all great labors are done. Like steam is the opinion of political masses! If crushed by castles, armies, and police, dangerously explosive; but if furnished with schools and the ballot, developing "the most harmless and energetic form of a state." His eyes were wide open to some of the evil intellectual effects of democracy. The individual is too apt to wear the time-worn yoke of the multitude's opinions. No multiplying of contemptible units can produce an admirable mass. "If I see nothing to admire in a unit, shall I admire a million units?" The habit of submitting to majority rule cultivates individual subserviency. He pointed out two generations ago that the action of violent political parties in a democracy might provide for the individual citizen a systematic training in moral cowardice.

It is interesting, at the stage of industrial warfare which the world has now reached, to observe how Emerson, 60 years ago, discerned clearly the absurdity of paying all sorts of service at one rate, now a favorite notion with some labor unions. He points out that even when all labor is temporarily paid at one rate, differences in possessions will instantly arise: "In one hand the dime became an eagle as it fell, and in another hand a copper cent. For the whole value of the dime is in knowing what to do with it." Emerson was never deceived by a specious philanthropy, or by claims of equality which find no support in the nature of things. He was a true democrat, but still could say: "I think I see place and duties for a nobleman in every society; but it is not to drink wine and ride in a fine coach, but to guide and adorn life for the multitude by forethought, by elegant studies, by perseverance, self-devotion, and the remembrance of the humble old friend — by making his life secretly beautiful." How fine a picture of the democratic nobility is that!

In his lecture on 'Man the Reformer,' which was read before the Mechanics' Apprentices' Association in Boston Jan. 1841, Emerson described in the clearest manner the approaching strife between laborers and employers, between poor and rich, and pointed out the cause of this strife in the selfishness, unkindness, and mutual distrust which ran through the community. He also described, with perfect precision, the only ultimate remedy — namely, the sentiment of love. "Love would put a new face on this weary old world in which we dwell as pagans and enemies too long. . . . The virtue of this principle in human society in application to great interests is obsolete and forgotten. But one day all men will be lovers; and every calamity will be dissolved in the universal sunshine." It is more than 60 years since those words were uttered, and in those years society has had large experience of industrial and social strife, of its causes and consequences, and of many attempts to remedy or soften it; but all this experience only goes to show that there is but one remedy for these ills. It is to be found in kindness, good fellowship, and the affections. In Emerson's words, "We must be lovers, and at once the

impossible becomes possible." The world will wait long for this remedy, but there is no other.

Like every real seer and prophet whose testimony is recorded, Emerson had intense sympathy with the poor, laborious, dumb masses of mankind, and being a wide reader in history and biography, he early arrived at the conviction that history needed to be written in a new manner. It was long before Green's History of the English People that Emerson wrote: "Hence it happens that the whole interest of history lies in the fortunes of the poor." In recent years this view of history has come to prevail, and we are given the stories of institutions, industries, commerce, crafts, arts, and beliefs, instead of the stories of dynasties and wars. For Emerson it is always feats of liberty and wit which make epochs of history. Commerce is civilizing because "the power which the sea requires in the sailor makes a man of him very fast." The invention of a house, safe against wild animals, frost, and heat, gives play to the finer faculties, and introduces art, manners, and social delights. The discovery of the post-office is a fine metre of civilization. The sea-going steamer marks an epoch; the subjection of electricity to take messages and turn wheels marks another. But, after all, the vital stages of human progress are marked by steps toward personal, individual freedom. The love of liberty was Emerson's fundamental passion:

For He that ruleth high and wise,  
Nor pauseth in His plan,  
Will take the sun out of the skies  
Ere freedom out of man.

The new National League of Independent Workmen of America has very appropriately taken its motto from Emerson:

For what avail the plough or sail  
Or land or life, if freedom fail?

The sympathetic reader of Emerson comes often upon passages written long ago which are positively startling in their anticipation of sentiments common to-day and apparently awakened by very recent events. One would suppose that the following passage was written yesterday. It was written 56 years ago. "And so, gentlemen, I feel in regard to this aged England, with the possessions, honors, and trophies, and also with the infirmities of a thousand years gathering around her, irretrievably committed as she now is to many old customs which cannot be suddenly changed; pressed upon by the transitions of trade, and new and all incalculable modes, fabrics, arts, machines, and competing populations — I see her not dispirited, not weak, but well remembering that she has seen dark days before; indeed, with a kind of instinct that she sees a little better in a cloudy day, and that in storm of battle and calamity, she has a secret vigor and a pulse like a cannon."

Before the Civil War the Jew had no such place in society as he holds to-day. He was by no means so familiar to Americans as he is now. Emerson speaks twice of the Jew in his essay on 'Fate,' in terms precisely similar to those we commonly hear to-day: "We see how much will have been expended to extinguish the Jew, in vain. . . . The sufferance which is the badge of the Jew has made him in these days the ruler of the rulers of the earth." Those keen observations were made certainly more than 40 years ago, and probably more than 50.



## EMERSON

Landscape architecture is not yet an established profession among us, in spite of the achievements of Downing, Cleveland, and Olmsted and their disciples; yet much has been accomplished within the last 25 years to realize the predictions on this subject made by Emerson in his lecture on 'The Young American.' He pointed out in that lecture that the beautiful gardens of Europe are unknown among us, but might be easily imitated here, and said that the landscape art "is the fine art which is left for us. . . . The whole force of all arts goes to facilitate the decoration of lands and dwellings. . . . I look on such improvement as directly tending to endear the land to the inhabitant." The following sentence might have been written yesterday, so consistent is it with the thought of to-day: "Whatever events in progress shall go to disgust men with cities, and infuse into them the passion for country life and country pleasures, will render a service to the whole face of this continent, and will further the most poetic of all the occupations of real life, the bringing out by art the native but hidden graces of the landscape." In regard to books, pictures, statues, collections in natural history, and all such refining objects of nature and art, which heretofore only the opulent could enjoy, Emerson pointed out that in America the public should provide these means of culture and inspiration for every citizen. He thus anticipated the present ownership by cities, or by endowed trustees, of parks, gardens, and museums of art or science, as well as of baths and orchestras. Of music in particular he said: "I think sometimes could I only have music on my own terms; could I . . . know where I could go whenever I wished the ablution and inundation of musical waves—that were a bath and a medicine." It has been a long road from that sentence, written probably in the forties, to the Symphony Orchestra in this hall and to the new singing classes on the East Side of New York.

For those of us who have attended to the outburst of novels and treatises on humble or squalid life, to the copious discussions on child-study, to the masses of slum literature, and to the numerous writings on home economics, how true to-day seems the following sentence written in 1837: "The literature of the poor, the feelings of the child, the philosophy of the street, the meaning of household life are the topics of the time."

I pass now to the last of the three topics which time permits me to discuss—Emerson's religion. In no field of thought was Emerson more prophetic, more truly a prophet of coming states of human opinion, than in religion. In the first place, he taught that religion is absolutely natural—not supernatural, but natural:

Out from the heart of Nature rolled  
The burdens of the Bible old.

He believed that revelation is natural and continuous, and that in all ages prophets are born. Those souls out of time proclaim truth, which may be momentarily received with reverence, but is nevertheless quickly dragged down into some savage interpretation which by and by a new prophet will purge away. He believed that man is guided by the same power that guides beast and flower. "The selfsame power that brought me here, brought you," he says to

beautiful Rhodora. For him worship is the attitude of those "who see that against all appearances the nature of things works for truth and right forever." He saw good not only in what we call beauty, grace, and light, but in what we call foul and ugly. For him a sky-born music sounds "from all that's fair; from all that's foul":

'Tis not in the high stars alone,  
Nor in the cups of budding flowers,  
Nor in the redbreast's mellow tone,  
Nor in the bow that smiles in showers,  
But in the mud and scum of things  
There always, always something sings.

The universe was ever new and fresh in his eyes, not spent, or fallen, or degraded, but eternally tending upward:—

No ray is dimmed, no atom worn,  
My oldest force is good as new,  
And the fresh rose on yonder thorn  
Gives back the bending heavens in dew.

When we come to his interpretation of historical Christianity, we find that in his view the life and works of Jesus fell entirely within the field of human experience. He sees in the deification of Jesus an evidence of lack of faith in the infinitude of the individual human soul. He sees in every gleam of human virtue not only the presence of God, but some atom of his nature. As a preacher he had no tone of authority. A true non-conformist himself, he had no desire to impose his views on anybody. Religious truth, like all other truth, was to his thought an unrolling picture, not a deposit made once for all in some sacred vessel. When people who were sure they had drained that vessel, and assimilated its contents, attacked him, he was irresponsive or impassive, and yielded to them no juicy thought; so they pronounced him dry or empty. Yet all of Emerson's religious teaching led straight to God,—not to a withdrawn creator, or anthropomorphic judge or king, but to the all-informing, all-sustaining soul of the universe.

It was a prophetic quality of Emerson's religious teaching that he sought to obliterate the distinction between secular and sacred. For him all things were sacred, just as the universe was religious. We see an interesting fruition of Emerson's sowing in the nature of the means of influence, which organized churches and devout people have, in these later days, been compelled to resort to. Thus the various religious denominations keep their hold on their natural constituency quite as much by schools, gymnasiums, hospitals, entertainments, and social parades as by their rites and preaching. They maintain in city slums "settlements," which use secular rather than the so-called sacred methods. The fight against drunkenness, and the sexual vice and crimes of violence which follow in its train, is most successfully maintained by eliminating its physical causes and providing mechanical and social protections.

For Emerson inspiration meant not the rare conveyance of supernatural power to an individual, but the constant incoming into each man of the "divine soul which also inspires all men." He believed in the worth of the present hour:

Future or Past no richer secret folds,  
Oh friendless Present! than thy bosom holds.

He believed that the spiritual force of human character imaged the divine:—

The sun set, but set not his hope:  
Stars rose; his faith was earlier up:

## EMERSON

Fixed on the enormous galaxy,  
Deeper and older seemed his eye.

Yet man is not an order of nature, but a stupendous antagonism, because he chooses and acts in his soul. "So far as a man thinks, he is free." It is interesting to-day, after all the long discussion of the doctrine of evolution, to see how the much earlier conceptions of Emerson match the thoughts of the latest exponents of the philosophic results of evolution.

The present generation of scholars and ministers have been passing through an important crisis in regard to the sacred books of Judaism and Christianity. All the features of the contest over "the higher criticism" are foretold by Emerson in 'The American Scholar.' "The poet chanting was felt to be a divine man; henceforth the chant is divine also. The writer was a just and wise spirit; henceforth it is settled the book is perfect. Colleges are built on it; books are written on it. . . . Instantly the book becomes noxious; the guide is a tyrant." This is exactly what has happened to Protestantism, which substituted for infallible Pope and Church an infallible Book; and this is precisely the evil from which modern scholarship is delivering the world.

In religion Emerson was only a 19th-century non-conformist, instead of a 15th- or 17th-century one. It was a fundamental article in his creed that, although conformity is the virtue in most request, "Whoso would be a man must be a non-conformist." In the midst of increasing luxury, and of that easy-going, unbelieving conformity which is itself a form of luxury, Boston, the birthplace of Emerson, may well remember with honor the generations of non-conformists who made her, and created the intellectual and moral climate in which Emerson grew up. Inevitably, to conformists and to persons who still accept doctrines and opinions which he rejected, he seems presumptuous and consequential. In recent days we have even seen the word "insolent" applied to this quietest and most retiring of seers. But have not all prophets and ethical teachers had something of this aspect to their conservative contemporaries? We hardly expect the messages of prophets to be welcome; they imply too much dissatisfaction with the present.

The essence of Emerson's teaching concerning man's nature is compressed into the famous verse:

So nigh is grandeur to our dust,  
So near is God to man,  
When Duty whispers low, Thou must,  
The youth replies, I can.

The cynic or the fall-of-man theologian replies — "Grandeur indeed, say rather squalor and shame." To this ancient pessimism Emerson makes answer with a hard question — "We grant that human life is mean, but how did we find out that it was mean?" To this question no straight answer has been found, the common answer running in a circle. It is hard indeed to conceive of a measure which will measure depths but not heights; and besides, every measure implies a standard.

I have endeavored to set before you some of the practical results of Emerson's visions and intuitions, because, though quite unfit to expound his philosophical views, I am capable of appreciating some of the many instances in

which his words have come true in the practical experience of my own generation. My own work has been a contribution to the prosaic, concrete work of building, brick by brick, the new walls of old American institutions of education. As a young man I found the writings of Emerson unattractive, and not seldom unintelligible. I was concerned with physical science, and with routine teaching and discipline; and Emerson's thinking seemed to me speculative and visionary. In regard to religious belief, I was brought up in the old-fashioned Unitarian conservatism of Boston, which was rudely shocked by Emerson's excursions beyond its well-fenced precincts. But when I had got at what proved to be my lifework for education, I discovered in Emerson's poems and essays all the fundamental motives and principles of my own hourly struggle against educational routine and tradition, and against the prevailing notions of discipline for the young. I cannot refuse the opportunity to point out how many of the sober, practical undertakings of to-day have been anticipated in all their principles by this solitary, shrewd, independent thinker, who, in an inconsecutive and almost ejaculatory way, wrought out many sentences and verses which will travel far down the generations. We know a good deal about the intellectual ancestors and inspirers of Emerson, and we are sure that he drank deep at many springs of idealism and poetry. Plato, Confucius, Shakespeare, and Milton were of his teachers; Oken, Lamarck, and Lyell lent him their scientific theories; and Channing stirred the residuum which came down to him through his forbears from Luther, Calvin, and Edwards. All these materials he transmuted and molded into lessons which have his own individual quality and bear his stamp. The precise limits of his originality are indeterminable, and inquiry into them would be unprofitable. In all probability the case would prove to be much the same with most of the men that the world has named prophets, if we knew as much of their mental history as we know of Emerson's. With regard to the Semitic prophets and seers, it is reasonable to expect that as Semitic exploration and discovery advance, the world will learn much about the historical and poetical sources of their inspiration. Then the Jewish and Christian peoples may come nearer than they do now to Emerson's conceptions of inspiration and worship, of the naturalness of revelation and religion, and of the infinite capacities of man. Meantime, it is an indisputable fact that Emerson's thought has proved to be consonant with the most progressive and fruitful thinking and acting of two generations since his working time. This fact, and the sweetness, fragrance, and loftiness of his spirit, prophesy for him an enduring power in the hearts and lives of spiritually minded men.

CHARLES W. ELIOT,  
President of Harvard University.

Emerson, Canada, town, in Provencher County, province of Manitoba, on the Red River, at the terminus of branches of the Great N., and Canadian P. R.R.'s, and on the boundary between the United States and Canada. It is situated in one of the greatest wheat-growing sections of the world. Pop. 1,023.









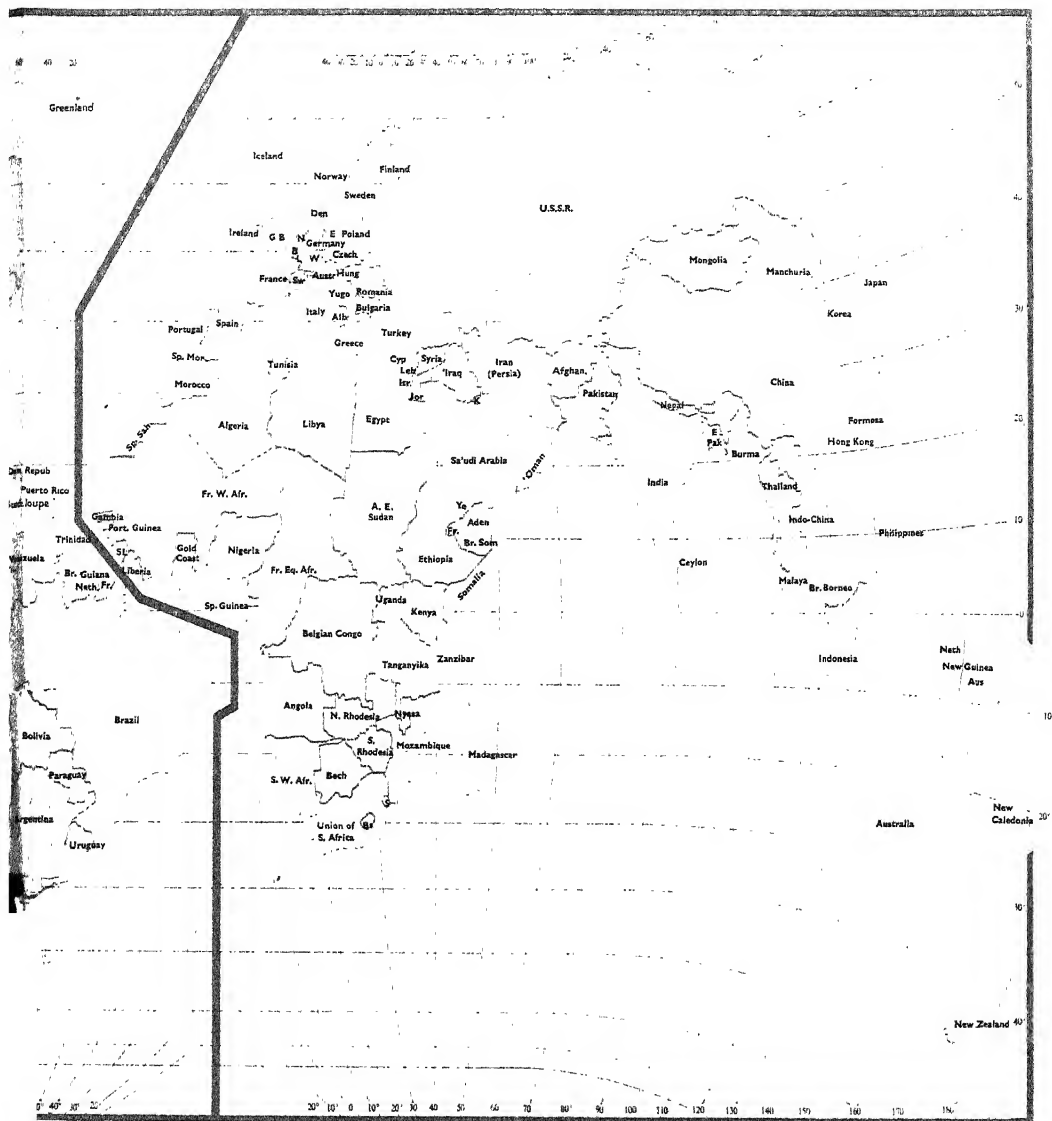












Graticule intersection S.W. of name

Pakistan (Pak.)  
Pakistan, East (E. Pak.)  
Panama (Pan.)  
Paraguay (Para.)  
Persia (see Iran)  
Peru  
Philippines (Phil.)  
Poland (Pol.)  
Portugal (Port.)  
Portuguese Guinea (Port. Guinea)  
Puerto Rico

Romania (Rom.)

Saudi Arabia (Sau. Arab.)  
Sierra Leone (SL)  
Somalia (Som.)  
Southern Rhodesia (S. Rhod.)  
S.W. Africa (S.W. Afr.)  
Spain (Sp.)  
Spanish Guinea (Sp. Guinea)  
Spanish Morocco (Sp. Mor.)  
Spanish Sahara (Sp. Sah.)  
Surinam (Sur.) see Guiana Neth.  
Swaziland (S.)  
Sweden (Swe.)  
Switzerland (Sw.)  
Syria (Syr.)

60° E 20° N  
90° E 20° N  
90° W 0°  
60° W 30° S  
80° W 10° S  
120° E 10° N  
10° E 50° N  
20° W 40° N  
20° W 10° N  
70° W 10° N  
20° E 40° N  
40° E 20° N  
20° W 20° N  
40° E 0°  
30° E 20° S  
10° E 20° S  
10° W 40° N  
0° 0°  
10° W 30° N  
20° W 20° N  
30° E 30° S  
10° E 50° N  
0° 40° N  
30° E 30° N

Graticule intersection S.W. of name

Tanganyika (Tangan.)  
Thailand (Thal.)  
Tunisia (Tun.)  
Turkey (Tur.)

30° E 10° S  
100° E 10° N  
0° 30° N  
30° E 30° N

Uganda (Ugan.)  
Union of S. Africa  
U.S.S.R.  
United Kingdom (U.K.) see Great Britain  
U.S.A.  
Uruguay (Uru.)

30° E 0°  
20° E 40° S  
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60° W 40° S

Venezuela (Venez.)

70° W 0°

Yemen (Ye)  
Yugoslavia (Yugo.)

40° E 10° N  
10° E 40° N

Zanzibar

40° E 10° S

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